REVA UNIVERSITY
Bengaluru, India

School of Computing and Information Technology

B.Tech. ISE

2020-24 Batch

HANDBOOK

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

HANDBOOK

B. Tech. Information Science and Engineering

(2020 – 2024 Batch)

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Rukmini Educational
Charitable Trust

www.reva.edu.in

Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge. As educators, it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is Power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju
The Founder and Honourable Chancellor, REVA University

Vice-Chancellor Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavour to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr.M.Dhanamjaya

Vice-Chancellor, REVA University

Director's Message

I congratulate and welcome all the students to the esteemed School of Computing and Information Technology (C & IT)). You are in the right campus to become a computer technocrat. The rising needs of automation in Industry 4.0 and improvising living standards have enabled rapid development of computer software and hardware technologies. Thus, providing scope and opportunity to generate more human resources in the areas of computers and IT. The B. Tech, M. Tech and Ph.D. programs offered in the school are designed to cater the requirements of industry and society. The curriculum is designed meticulously in association with persons from industries (TCS, CISCO, AMD, MPHASIS, etc.), academia and research organizations (IISc, IIIT, Florida University, Missouri S & T University, etc).

This handbook presents the B. Tech in Information Science and Engineering program curriculum. The program is of 4 years duration and split into 8 semesters. The courses are classified into foundation core, hard core, and soft-core courses. Hard core courses represent fundamentals study requirements of ISE. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Information Theory, Information Security, Information Communication and Information Systems. Theoretical foundations of engineering, science, and Information Science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization. The Curriculum caters to local, national, regional and global developmental needs. Maximum number of courses are integrated with cross cutting issues relevant to professional ethics, global needs, human values, environment and sustainability. The curriculum also focusses on skill development, innovation and entrepreneurship.

The important features of the B. Tech ISE are as follows:

1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Cloud Computing, Python/R Programming, NLP, IoT and Cloud security, 3) Short and long duration Internships 4) Opportunity to pursue MOOC course as per the interest in foundation and soft core courses, 5) Attain global and skill certification as per the area of specialization, 6) Self-learning components, 7) Experiential, practice, practical, hackathons, and project based learning, 8) Mini projects and major projects with research orientation and publication, 9) Soft skills training and 10) Platform for exhibiting skills in cultural, sports and technical activities through clubs and societies. The school has well qualified faculty members in the various areas of computing and IT including cloud computing, security, IOT, AI, ML and DL, software engineering, computer networks, information technology, cognitive computing, block chain technology etc. State of art laboratories are available for the purpose of academics and research.

Dr. Mallikarjun M Kodabagi

Director, School of Computing and Information Technology

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RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of **Rukmini Educational Charitable Trust (RECT),** in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjay Nagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 15,000+ students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7th February, 2013. The University is recognised by UGC under Sec 2 (f) and empowered under Sec.22 of the UGC Act, 1956 to award degrees in any branch of knowledge. The Programs of the University are approved by All India Council for Technical Education (AICTE), University Grants Commission (UGC), Bar Council of India (BCI), and Council of Architecture (COA). The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempe Gowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, auditoriums, seminar halls, custom-built teaching facilities, fully air-conditioned library and central computer centre, well-planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 26 Post Graduate Degree programs, 35 Undergraduate programs in various branches of studies and has 15000+ students studying in various branches of knowledge at graduate and post graduate level and 494 Scholars pursuing research leading to PhD in 19 disciplines. It has 900+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis on knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given importance while designing the curricula.

The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, Big data analytics, Information Retrieval, VLSI and Embedded Systems, Wireless Sensor Networks, Artificial Intelligence, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, , LED Lighting, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor and Dean, and supported by well experienced Trainers, Counsellors and Placement Officers. The University also has University-Industry Interaction (UIIC) and Skill Development Centre headed by a Senior Professor and Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs, Entrepreneurship activities, and IPR workshops. UIIC has established REVA NEST, an incubation centre for promoting start up industries.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, University of California Berkeley, Arkansas State University, Columbia University, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, *EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitate students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy,

Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such awards instituted by REVA University is **'Life Time Achievement Award'** to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the **"Founders' Day Celebration"** of REVA University on 6th January of every year in presence of dignitaries, faculty members and students gathering. The first "**REVA Life Time Achievement Award**" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence"** in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVOTHASAVA conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Within short span of time, REVA University has been recognised as a fast-growing university imparting quality higher education to the youth of the country and received many awards, ranks, and accolades from various agencies, institutions at national and international level. These include: Asia's Greatest Brand and Leaders, by Asia One, National Award of Leadership Excellence, by ASSOCHAM India, Most promising University, by EPSI, Promising Upcoming Private University in the Country, by The Economic Times, Best University of India (South), by Dialogue India, Gold Brand by QS University Ranking, placed under 151-200 band by NIRF, 6TH Rank in the Super Excellence category by GHRDC, 6TH Rank in All India Law School Survey, ranked among Top 30 Best B Schools by Business World, India's Best Law Institution by Careers 360, to mention a few.

REVA University

Vision

''REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards".

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner.

ABOUT THE SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

The school has a rich blend of experienced and committed faculty who are well-qualified in various aspects of computing and information technology apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The School offers four full-time undergraduate programs, B. Tech in Computer Science and Engineering (Artificial Intelligence and Machine Learning), B. Tech in Computer Science and Information Technology, B. Tech in Computer Science and Systems Engineering, B. Tech in Information Science and Engineering and the following two postgraduate programs: M.Tech in Artificial Intelligence and M.Tech in Cyber security. In addition, the school has a research centre in which students can conduct cutting edge research leading to a Ph.D. degree.

Curriculum of both undergraduate and postgraduate programs have been designed through a collaboration of academic and industry experts in order to bridge the growing gap between industry and academia. This makes the program highly practical-oriented, and thus industry-resilient. The B. Tech programs aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world. The masters' degrees focus on quality research and design in the core and application areas of Artificial Intelligence and Information Technology to foster a sustainable world and to enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters' programs.

School Vision

To produce excellent quality technologists and researchers of global standards in computing and Information technology who have potential to contribute to the development of the nation and the society with their expertise, skills, innovative problem-solving abilities, strong moral and ethical values.

School Mission

- To create state of the art computing labs infrastructure and research facilities in information technology.
- To provide student-centric learning environment in Computing and Information technology through innovative pedagogy and education reforms.
- To encourage research, innovation and entrepreneurship in computing and information technology through industry/academia collaborations and extension activities
- Organize programs through club activities for knowledge enhancement in thrust areas of information technology.
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism, moral and ethical values.

Quality Policy

The school of computing and Information Technology is committed to excellence through following policies.

1. Impart quality education by providing state of art curriculum, experimental learning, and state of the art labs.
2. Enhance skill set of faculty members through faculty development programmes and interaction with academia and industries.
3. Inculcate the competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exhibition, Internship and Entrepreneurship Programme.
4. Provide soft skill and skill development training for personality development and better placement.
5. Promote innovation and research culture among students and support faculty members for better research and development activity.

MEMBERS OF BOARD OF STUDIES

Sl. No.	Name		Correspondence Address
1	**Dr. Mallikarjun M Kodabagi** Professor and Director School of Computing and Information Technology REVA University	Chairperson	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
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6.	**Sreenivasa Ramanujam Kanduri** Academic Relationship Manager, TCS	Member (Industry Expert)	Academic Relationship Manager, Tata Consultancy Services, Bangalore.
7.	**Dr. Sundar K S** Associate Vice-President & Head, IMS Academy at Infosys	Member (Industry Expert)	Associate Vice-President & Head, IMS Academy at Infosys, Mysore
8.	**Dr. Ramabrahmam Gunturi** Consultant, TCS	Industry Expert	Tata Consultancy Services, Hyderabad.
9.	**Dr. S. A. Angadi** Professor, School of CSE,VTU	Academic Expert	Professor, School of CSE Visvesvaraya, Belagavi
10.	**Dr. Bharati Arakeri** Professor**,** School of CSE BMSIT, Bangalore.	Academic Expert	Professor**,** School of CSE BMSIT, Bangalore
11.	**Abhishek Revanna Swamy** Associate Project Manager, Robert Bosch	Alumni-Member	Associate Project Manager, Robert Bosch, Bangalore
12.	**Prasad Chitta** Solution Architect, TCS Bangalore	Member (Industry Expert)	Solution Architect, TCS, Bangalore

B. Tech. Information Science & Engineering

Program Overview

Information Science & Engineering (ISE) encompasses a variety of topics that relates to computation, like development of algorithms, analysis of algorithms, programming languages, Information retrieval, Information analysis, software design and computer hardware. Information Science & Engineering has roots in electrical engineering, mathematics, and linguistics. In the past Information Science was taught as part of mathematics or engineering departments and in the last 3 decades it has emerged as a separate engineering field. In the present information era (Knowledge era) Information Science & Engineering will see an exponential growth as the future machines work on Data Analytics.

The oldest known complex computing device, called the Antikythera mechanism, dates back to 87 B.C., to calculate astronomical positions and help Greeks navigate through the seas. Computing took another leap in 1843, when English mathematician Ada Lovelace wrote the first computer algorithm, in collaboration with Charles Babbage, who devised a theory of the first programmable computer. But the modern computing-machine era began with Alan Turing's conception of the Turing Machine, and three Bell Labs scientists' invention of the transistor, which made modern-style computing possible, and landed them the 1956 Nobel Prize in Physics. For decades, computing technology was exclusive to the government and the military; later, academic institutions came online, and Steve Wozniak built the circuit board for Apple-1, making home computing practicable. On the connectivity side, Tim Berners-Lee created the World Wide Web, and Marc Andreessen built a browser, and that's how we came to live in a world where our glasses can tell us what we're looking at. With wearable computers, embeddable chips, smart appliances, and other advances in progress and on the horizon, the journey towards building smarter, faster and more capable computers is clearly just beginning.

Computers have become ubiquitous part of modern life, and new applications are introduced every day. The use of computer technologies is also commonplace in all types of organizations, in academia, research, industry, government, private and business organizations. As computers become even more pervasive, the potential for computer-related careers will continue to grow and the career paths in computer-related fields will become more diverse. Since 2001, global information and communication technologies (ICTs) have become more powerful, more accessible, and more widespread. They are now pivotal in enhancing competitiveness, enabling development, and bringing progress to all levels of society.

The career opportunities for Information Science & Engineering graduates are plenty and growing. Programming and software development, information systems operation and management, data science, information retrieval, big data analytics, telecommunications and networking, Machine Learning development, computer science research, web and Internet, graphics and multimedia, training and support, and computer industry specialists are some of the opportunities the graduates find.

The School of Computing and Information Technology at REVA UNIVERSITY offers B. Tech., Information Science & Engineering programme to create motivated, innovative, creative thinking graduates to fill ICT positions across sectors who can conceptualize, design, analyze, and develop ICT applications to meet the modern-day requirements.

The B. Tech., in Information Science & Engineering curriculum developed by the faculty at the School of Computing and Information Technology, is outcome based and it comprises required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, innovative, creative thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. The above-mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with ICT sector makes this programme unique.

This program involves various courses which are related to computation, like design and analysis of algorithms, computer programming languages, software design, Information Theory, IoT and Smart Sensors, Agile Software Engineering and DevOps, Big Data and Hadoop, Python for Data Analysis, Machine Learning and Information Science, Cloud Computing, Computer Vision, Business Intelligence, Information Retrieval, Management Information Systems, AI and Agents, Fuzzy Logic and Systems, Data Analytics Using "R", Multi Media Systems, Introduction to Drones. Block Chain Technology, Swarm Intelligence, Software Defined Networks and NFV, Natural Language Processing, Augmented and Virtual Reality, Robotic Process Automation, Deep Learning and Reinforcement Learning, UI/UX Design, Cyber Forensics. This program also has courses such as electrical and electronics engineering, applied sciences and linguistics. This specialization is proposed to enable students to design software to solve problems in industry and engineering that require computers.

Program Educational Objectives (PEO's)

After few years of graduation, the graduates of B. Tech (Information Science and Engineering) will:

- **PEO-1:** Communicate as a member in team and provide solutions in the area of expertise in software Industry.
- **PEO-2:** Start enterprise to improve the economy of the country for provide support to the customers with an attitude of lifelong learning.
- **PEO-3:** Pursue higher education in the field of Information Science and Engineering in allied areas.

Programme Outcomes (PO's)

On successful completion of the programme, the graduates of **B. Tech (Information Science and Engineering)** program will be able to:

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering.

- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO-9: Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's)

On successful completion of the program, the graduates of B. Tech (Information Science and Engineering) program will be able to:

- **PSO-1**: Develop and write algorithms in Information Science and Engineering
- **PSO-2**: Analyze and Solve problems in the field of Information Science and Engineering and address the real-life situations in the industry.
- **PSO-3**: Use different tools and techniques in Information Science and Engineering and allied areas.

REVA University Academic Regulations

B. Tech Degree Programs

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

Title and Commencement:

These Regulations shall be called "REVA University Academic Regulations – B. Tech Degree Program 2020-21 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management

These Regulations shall come into force from the date of assent of the Chancellor.

The Programs:

These regulations cover the following B. Tech Degree programs of REVA University offered during 2020-21.

B. Tech in:

Bioelectronics Engineering
Civil Engineering
Computer Science and Engineering
Computer Science and Information Technology
Computer Science and Systems Engineering
Computer Science and Engineering (AI and ML)
Electrical and Electronics Engineering
Electrical and Computer Engineering
Electronics and Communication Engineering
Electronics and Computer Engineering
Information Science and Engineering
Mechanical Engineering
Mechatronics Engineering

Duration and Medium of Instructions:

Duration: The duration of the B. Tech degree program shall be FOUR years comprising of EIGHT Semesters. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the school when he/she resumes his/her studies.

The medium of instruction shall be English.

Definitions:

Course: “Course” means a subject, either theory or practical or both, listed under a program; Example: “Fluid Mechanics” in B. Tech Civil Engineering program, Engineering Thermodynamics in B. Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

L	Lecture
T	Tutorial
P	Practice

Where:

L stands for Lecture session consisting of classroom instruction.

T stands for Tutorial session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for Practice session and it consists of Hands-on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much-required skill component.

4.2 Classification of Courses

Courses offered are classified as: Core Courses, Open Elective Courses, Project work/Dissertation

Core Course: A course which should compulsorily be studied by a candidate choosing a particular program of study.

Foundation Course: The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study.

Hard Core Course (HC) simply core course: The Hard-Core Course is a Core Course in the main branch of study and related branch (es) of study, if any, that the candidates have to complete compulsorily.

Soft Core Course (SC) (also known as Professional Elective Course)

A Core course may be a Soft Core if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

Open Elective Course (OE):

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an Open Elective Course.

Project Work / Dissertation:

Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems. The project will be conducted in two phases, Phase-I (7th Semester), consists of literature survey, problem identification, formulation and methodology. In Phase-II (8th Semester) student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work carrying TWO, FOUR or SIX credits is called Minor Project work / Dissertation. A project work of SIX, EIGHT, or TEN, credits is called Major Project work / Dissertation. A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned. But the Major Project shall be Hard Core.

"Program" means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma Degree or such other degrees instituted and introduced in REVA University.

Eligibility for Admission:

5.1. The eligibility criteria for admission to B. Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B. Tech)	4 Years (8 Semesters)	Passed 10+2 examination with Physics and Mathematics as compulsory subjects, along with any one of the following subjects, namely, Chemistry, Bio-Technology, Computer Science, Biology, Electronics and Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology (B. Tech)	Lateral entry to second year	(A) Passed Diploma examination from an AICTE approved Institution with at least 45% marks (40% in case of candidates belonging to SC/ST category) in appropriate branch of Engineering / Technology. (B) Passed B. Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. (C) Provided that in case of students belonging to B. Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects.

			(D) Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream. (E) Provided further that student, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However, the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above.
3	Bachelor of Technology (B. Tech)	Lateral entry to fourth year (final year)	(F) Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the University requirements.
5	B. Tech. in Bioelectronics		Pass in PUC /10+2 examination with Physics, Biology/Biotechnology as compulsory along with at least one of the Chemistry/Mathematics / Computer Science / Electronics obtained minimum 45% marks (40% in case of candidates belonging to SC / ST category) in the above subjects taken together of any board recognized by the respective State Government / Central Government / Union Territories or any other qualification recognized as equivalent there to.

Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

Courses of Study and Credits

Each course of study is assigned with certain credit value

Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for final examination, evaluation and announcement of results

The credit hours defined as below

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

Credit = 13 credit hours spread over 16 weeks or spread over the semester

The total duration of a semester is 20 weeks inclusive of semester-end examination.

The following table describes credit pattern

Table -2: Credit Pattern					
Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total Contact Hours
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4

The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

Different Courses of Study:
Different Courses of Study are labeled as follows:
Core Course (CC)
Foundation Course (FC)
Hard Core Course (HC)
Soft Core Course (SC)
Open Elective Course (OE)
Project Work / Dissertation:

A project work carrying TWO, FOUR or SIX credits is called Minor Project work / Dissertation. A project work of EIGHT, TEN, TWELVE or SIXTEEN credits is called Major Project work / Dissertation. A Project work may be a hard core or a Soft Core as decided by the BoS / concerned.

These are defined under Section 4 of these regulations.

Credits and Credit Distribution

A candidate has to earn 160 credits for successful completion of B. Tech degree with the distribution of credits for different courses as given in table below:

Course Type	Credits (Range)
	For B. Tech Degree (8 Semesters)
Foundation Core Course	A minimum of 06 but not exceeding 12
Hard Core Course	A minimum of 118 but not exceeding 121
Soft Core Course	A minimum of 15 but not exceeding 21
Open Elective	A minimum of 04 but not exceeding 12

8.2. The concerned BOS based on the credits distribution pattern given above shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field

work, self-study elective, as Foundation Course (FC), Hard Core (HC) or Soft Core (SC), Open Elective (OE).

8.3. Every course including project work, practical work, field work, self-study elective should be entitled as Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE) or Core Course (CC) by the BoS concerned. However, following shall be the Foundation Courses with credits mentioned against them, common to all branches of study.

Sl. No.	Course Title	Number of Credits
Foundation Courses		
1	English for Technical Communication / Communication Skills	2
2	Environmental Studies / Environmental Science	2
3	Indian Constitution and Professional Ethics	2
4	MOOC / Internship /Soft Skill Training	6-15

8.4. The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.

8.5. A candidate can enrol for a maximum of 28 credits and a minimum of 19 credits per Semester. However he / she may not successfully earn a maximum of 28 credits per semester. This maximum of 28 credits does not include the credits of courses carried forward by a candidate.

Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 160 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

Add- on Proficiency Certification:

To acquire Add on Proficiency Certification a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B. Tech Degree program.

Add on Proficiency Diploma / Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree:, a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B. Tech Degree program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so issued to the candidate contains the courses studied and grades earned.

Assessment and Evaluation

The Scheme of Assessment will have two parts, namely;

Internal Assessment (IA); and

Semester End Examination (SEE)

Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

The 50 marks of internal assessment shall comprise of:

Internal Test	30 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes etc.	20 marks

There shall be two Internal Tests conducted as per the schedule announced below. The students shall attend both the Tests compulsorily.

1st test is conducted for 15 marks during 6th week of the semester;

2nd test is conducted for 15 marks during 12th week of the of the semester;

The coverage of syllabus for the said tests shall be as under:

Question paper of the 1st test should be based on first 40 %of the total syllabus;

Question paper of the 2nd test should be based on second 40 %of the total syllabus;

An assignment must be designed to cover the last 20% of the syllabus

There shall be one Assignment / Project Based Learning / Field Visit / Quiz test carrying 20 marks covering the last 20% of the Syllabus

The Semester End Examination for 50 marks shall be held in the 18th and 19th week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.

A test paper is set for a maximum of 30 marks to be answered in 1 hour duration. A test paper can have 4 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totalling 10 marks. Students are required to answer any three main questions. Each question is set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document.

The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by the Question Paper Scrutiny Committee to bring in the uniformity in the question paper pattern and as well to maintain the necessary standards.

The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An assignment / Quiz can be set for a maximum of 20. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.

Internal assessment marks must be decided well before the commencement of Semester End examinations

Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 18th and 19th week of the semester and the entire course syllabus must be covered while setting the question paper.

Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have a 3-4 sub questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document. (Please note question papers have to be set to test the course outcomes)

There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

There shall be single evaluation by the internal teachers who have taught the subject. However, there shall be moderation by the external examiner. In such cases where sufficient number of external examiners are not available to serve as moderators internal senior faculty member shall be appointed as moderators.

Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

There shall also be an Program Assessment Committee (PAC) comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. The Examination Review Committee shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

The report provided by the Examination Review Committee shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program

During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC

University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper

Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor

Online courses may be offered as per UGC norms.

For online course assessment guidelines would be as follows:

If the assessment is done by the course provider, then the school can accept the marks awarded by the course provider and assign the grade as per REVA University norms.

If the assessment is not done by the course provider, then the assessment is organized by the concerned school and the procedure explained in the regulation will apply

In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits

IAs for online courses could be avoided and will remain the discretion of the school.

The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

Utilization of one or two credit online courses would be:

4 week online course – 1 credit

8 week online course / MOOC – 2 credits

12 week online course / MOOC – 3 credits

Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	when	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 6th week	First 40%	30	15	7th week
2	Test -2	During 12th Week	Second 40%	30	15	13th Week
3	Assignment / Quiz	15th Week	Last 20%	20	20	16th Week
4	SEE	18/19th Week	100%	100	50	20th Week

Assessment of Students Performance in Practical Courses

The performance in the practice tasks / experiments shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

The 50 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of experiment and write up about the experiment.	20 marks
	Total	**50 marks**

10.2 The 50 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conducting of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

10.3 The duration for semester-end practical examination shall be decided by the concerned School Board.

For MOOC and Online Courses assessment shall be decided by the BOS of the School.

For > 3 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
	Total	**100 marks**

For 1 & 2 credit courses

i	IA-I	15 marks
ii	IA-2	15 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	20 marks
	Total	**50 marks**

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks (P=[IA + SEE]) secured by a candidate in a course which is rounded to nearest integer. V is the credit value of course. G is the grade and GP is the grade point.

Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : SGPA (Si) = $\sum(Ci \times Gi) / \sum Ci$ where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
Course 7	3	O	10	3X10=30
	19			**159**

Thus, SGPA = 159 ÷ 19 = 8.37

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
Course 7	2	B+	7	2X7=21
Course 8	2	O	10	2X10=20
	24			**175**

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus, SGPA = 199 ÷ 24 = 8.29

Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (160) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	19	6.83	19 x 6.83 = 129.77
2	21	7.29	21 x 7.29 = 153.09
3	22	8.11	22 x 8.11 = 178.42
4	22	7.40	22 x 7.40 = 162.80
5	22	8.29	22 x 8.29 = 182.38
6	22	8.58	22 x 8.58 = 188.76
7	22	9.12	22 x 9.12 = 200.64
8	10	9.25	10 x 9.25 =92.50
Cumulative	**160**		**1288.36**

Thus, CGPA = 19x6.83+21x7.29+22x8.11+22x7.40+22x8.29+22x8.58+22x9.12+10x9.25 = 8.05

Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:
Percentage of marks scored = CGPA Earned x 10
Illustration: CGPA Earned 8.05 x 10=80.5

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index) G	Letter Grade	Performance	FGP Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

Provisional Grade Card: The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides Semester Grade Point Average (SGPA).

Final Grade Card: Upon successful completion of B. Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

14. Attendance Requirement:

14.1 All students must attend every lecture, tutorial and practical classes.

14.2 In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

14.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc, during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

15. Re-Registration and Re-Admission:

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

Absence during Internal Test:

In case a student has been absent from an internal test due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

17.1. If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

18. **Grievance Committee:**

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

The Controller of Examinations - Ex-officio Chairman / Convener

One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.

One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

Provision to Carry Forward the Failed Subjects / Courses:

The student who has failed in a maximum of 4 courses in odd and even semesters together shall move to next semester of succeeding year(s) of study till 8th semester. And he / she shall appear for Semester End examination of failed courses of previous semesters concurrently with odd semester end examinations and / or even semester end examinations of current year of study.

Examples:-

Student "A" has failed in 1 Course in First Semester and 3 Courses in Second Semester. He / she is eligible to seek admission for Third Semester and appear for Semester End Examination of 1 failed Course of First Semester concurrently with Third Semester end examination. Likewise, he / she is eligible to appear for Semester End Examination of 3 failed Courses of Second Semester concurrently with Fourth Semester end examination.

Student "B" has failed in 2 Courses of First Semester and 2 Courses in Fourth Semester and has passed in all Courses of First and Second Semesters. He / she is eligible to seek admission to Fifth Semester and appear for Semester End Examination of 2 failed Courses of First Semester concurrently with Fifth Semester end examination. Likewise he / she is eligible to appear for Semester End Examination of 2 failed Courses of Fourth Semester concurrently with Sixth Semester end examination.

Student "C" has failed in one course in Second Semester one course in third semester and two courses in fifth semester and has cleared all other courses from first semester to Sixth Semester. He / She has also passed all the courses of First to Sixth Semesters. Student "C" is eligible to seek admission for Seventh Semester and appear for Semester End Examination of one failed Course of Second Semester, one course of third semester and two courses in fifth semester concurrently with Seventh Semester end examination. However, he / she has to pass all the failed courses of Second Semester, Third Semester and Fifth Semester along with Seventh and Eighth Semesters courses to earn B. Tech Degree.

Student "D" failed in three courses in first semester and one course in second semester, but has passed in all the courses of second to sixth semester. Student "D" is also eligible to seek admission for 7th Semester and appear for Semester End Examination of 3 failed courses of 1st Semester and one course of second semester concurrently with 7th Semester and 8th semester end examinations. However, he / she has to pass three failed courses of first semester and one failed course of second semester along with Seventh and Eighth Semester courses to earn B. Tech Degree.

The student failed in any course(s) in any of the first to eight semesters has to pass all the failed courses of all Semesters within the double duration to earn B. Tech Degree failing which he / she has to seek re-admission to the program afresh.

Challenge Valuation:

a) A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Controller of Examinations within 10 days after the announcement of the results. This challenge valuation is only for semester end examination.
b) The answer scripts (in whatever form) for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

School of Computing and Information Technology
Scheme of Instructions (2020 – 2024 Batch)
B. Tech ISE

I SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20AS0105	Multivariable Calculus and Linear Algebra	HC	3	0	0	3	3
2	B20EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	1	4	5
3	B20CI0101	Introduction to Python Programming	FC	2	0	1	3	4
4	B20AS0104	Engineering Chemistry	HC	3	0	0	3	3
TOTAL				**11**	**0**	**2**	**13**	**15**
	Practical /Term Work / Practice Sessions /MOOCs							
5	B20ME0102	Design Thinking	FC	1	0	1	2	3
6	B20AS0109	Biology for Engineers	FC	1	0	0	1	1
7	B20ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4
TOTAL				**4**	**0**	**2**	**6**	**8**
TOTAL SEMESTER CREDITS							**19**	
TOTAL CUMULATIVE CREDITS							**19**	
TOTAL CONTACT HOURS							**23**	

II SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20AS0204	Probability and Statistics	HC	4	0	0	4	4
2	B20AS0106	Physics for Computer Science	HC	3	0	0	3	3
3	B20CS0101	Introduction to Data Science	FC	2	0	1	3	4
4	B20CE0201	Basics of Civil and mechanical Engineering	HC	3	0	1	4	5
5	B20CS0102	Programming for Problem Solving	HC	3	0	1	4	5
TOTAL				**15**	**0**	**3**	**18**	**21**
	Practical /Term Work / Practice Sessions /MOOCs							
6	B20EC0101	IoT and Applications	FC	1	0	1	2	3
7	B20ME0104	Entrepreneurship	FC	1	0	0	1	1
TOTAL				**2**	**0**	**1**	**3**	**4**
TOTAL SEMESTER CREDITS							**21**	
TOTAL CUMULATIVE CREDITS							**40**	
TOTAL CONTACT HOURS							**25**	

III SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0301	Analog and Digital Electronics.	HC	3	0	1	4	5
2	B20CI0302	Programming with JAVA	HC	3	0	1	4	5
3	B20CI0303	Data Structures	HC	3	0	1	4	5
4	B20AS0302	Discrete Mathematics and Graph Theory	HC	3	0	0	3	3
5	B20CI0304	Agile Software Development and Devops	HC	3	0	0	3	3
TOTAL				**15**	**0**	**3**	**18**	**21**
	Practical /Term Work / Practice Sessions /MOOCs							
6	B20MGM301	Management Science	FC	2	0	0	2	2
7	B20AS0301	Environmental Science	FC	2	0	0	2	2
8	B20AHM301 OR B20AHM302	Advanced Kannada OR Basics of Kannada	MC	0	0	0	0	0
TOTAL				**4**	**0**	**0**	**4**	**4**
TOTAL SEMESTER CREDITS							**22**	
TOTAL CUMULATIVE CREDITS							**62**	
TOTAL CONTACT HOURS							**25**	

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0401	Design and Analysis of Algorithms	HC	3	0	1	4	5
2	B20CI0402	Unix Operating System	HC	3	0	1	4	5
3	B20CI0403	Database Management System	HC	3	0	1	4	5
4	B20EJ0401	Computer Organization and Architecture	HC	3	0	0	3	3
5	B20AS0401	Numerical Methods and Optimization Techniques	HC	3	0	0	3	3
6	B20EJ0402	Theory of Computation	HC	3	0	0	3	3
TOTAL				**18**	**0**	**3**	**21**	**24**
Practical /Term Work / Practice Sessions /MOOCs								
7	B20AH0301	Communication Skills	FC	2	0	0	2	2
8	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
9	B20AHM401	Universal human values	MC	0	0	0	0	0
TOTAL				**4**	**0**	**0**	**4**	**4**
TOTAL SEMESTER CREDITS							**25**	
TOTAL CUMULATIVE CREDITS							**87**	
TOTAL CONTACT HOURS							**28**	

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EJ0501	Web Technologies and Applications	HC	3	0	0	3	3
2	B20CI0501	Computer Networks	HC	3	0	0	3	3
3	B20CI0502	Machine Learning	HC	3	0	0	3	3
4	B20EQ0501	Information Theory & Coding	HC	3	0	0	3	3
5	B20EXS5(01-05)	Professional Elective-I	SC	3	0	0	3	3
6	B20XXO5XX	Open Elective-I	OE	3	0	0	3	3
7	B20EJ0504	Web Technologies and Applications Lab	HC	0	0	1	1	2
8	B20CI0505	Machine Learning Lab	HC	0	0	1	1	2
9	B20CI0506	Computer Networks Lab	HC	0	0	1	1	2
TOTAL				**18**	**0**	**3**	**21**	**24**
	Practical /Term Work / Sessions							
10	B20CI0503	Technical Documentation	FC	1	0	0	1	1
11	B20EJ0503	Software Testing	HC	1	0	1	2	3
TOTAL				**2**	**0**	**1**	**3**	**4**
TOTAL SEMESTER CREDITS							**24**	
TOTAL CUMULATIVE CREDITS							**111**	
TOTAL CONTACT HOURS							**28**	

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EJ0601	Information and Network Security	HC	3	0	0	3	3
2	B20EQ0601	Information Retrieval System	HC	3	0	0	3	3
3	B20EXS6(01-06)	Professional Elective-II	SC	3	0	0	3	3
4	B20EXS6(07-09)	Professional Elective-III	SC	3	0	0	3	3
5	B20EXS6(10-12)	Professional Elective-IV	SC	3	0	0	3	3
6	B20XXO6XX	Open Elective-II	OE	3	0	0	3	3
7	B20EJ0603	Information and Network Security Lab	HC	0	0	1	1	2
8	B20EQ0602	Information Retrieval Systems Lab	HC	0	0	1	1	2
TOTAL				**18**	**0**	**2**	**20**	**22**
	Practical /Term Work / Sessions							
9	B20CI0601	Research Based Mini Project	HC	0	0	1	1	4
10	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	1
11	B20EQ0603	Modern Database	HC	1	0	1	2	3
TOTAL				**2**	**0**	**2**	**4**	**8**
TOTAL SEMESTER CREDITS							**24**	

TOTAL CUMULATIVE CREDITS	**136**
TOTAL CONTACT HOURS	**28**

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EXS7 (01-03)	Professional Elective-V	SC	3	0	0	3	3
2	B20XXO7XX	Open Elective-III	OE	3	0	0	3	3
			TOTAL	**6**	**0**	**0**	**6**	**6**
	Practical /Term Work / Sessions							
3	B20CI0701	Summer Internship/Global Certification	HC	0	0	3	3	6
4	B20CI0702	Project Phase-I	HC	0	0	4	4	8
			TOTAL	**0**	**0**	**7**	**7**	**14**
TOTAL SEMESTER CREDITS							**13**	
TOTAL CUMULATIVE CREDITS							**149**	
TOTAL CONTACT HOURS							**20**	

VIII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0801	Capstone-Project Phase-II	HC	0	0	8	8	16
TOTAL				**0**	**0**	**8**	**8**	**16**
Practical /Term Work / Practice Sessions /MOOCs								
2	B20XXO8XX	Open Elective-IV	OE	3	0	0	3	3
TOTAL				**3**	**0**	**0**	**3**	**3**
TOTAL SEMESTER CREDITS							**11**	
TOTAL CUMULATIVE CREDITS							**160**	
TOTAL CONTACT HOURS							**19**	

Professional Electives

Professional Electives with specialization in IT						
	Code	**Course**	**Code**	**Course**	**Code**	**Course**
PE-I/V sem	20EQS501	Digital Communications	B20EJS502	System Software	B20EJS503	Mobile Application Development
	B20EJS504	Human Computer Interaction	B20EQS505	Data Mining		
PE-II/ VI sem	B20EQS601	Virtualization and Cloud Computing	B20EQS602	Advanced DBMS	B20EQS603	Big Data Analytics
	B20EJS604	Block Chain Technology	B20EQ605	Multi Agent Systems	B20EJS606	Neural Networks and Deep learning
PE-III/ VI sem	B20EQS607	Image processing and Computer Vision	B20EQS608	Data Centre Technology	B20EJS609	Compiler Design
PE-IV/ VI sem	B20EQS611	Storage Area Networks	B20EJS610	Natural Language Processing in AI	B20EQS612	Full Stack Development
PE-V/ VII sem	B20EJS701	Multimedia Systems	B20EJS702	Augmented and Virtual Reality	B20EJS703	Soft Computing systems

Open Electives Offered to Other schools											
5TH SEM /OE-I			**6th SEM /OE-II**			**7th SEM /OE-III**			**8th SEM /OE-IV**		
Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School
B20CIO501	Introduction to AI	CIT	B20CIO601/602	Data Mining/ Machine Learning	CIT	B20CIO701	Python for data science	CIT	B20CIO801	IoT Programming	CIT
B20CIO502/503	OOPS with C++/ Web technology	CIT	B20CIO603	Neural Networks	CIT	B20CIO702	Deep Learning	CIT	B20CIO802	Reinforcement Learning	CIT

Skill Development Programs

Skill Development Programs (by Clubs/Industries/Corporate-Trainers/School-Faculty)		
GitHub and Open Source Technologies	Project Development Tools	Ethical Hacking
Cyber Security and Forensics	Cyber Physical Systems	IOT And Cloud Convergence
Graphics With Open Source Tools	AR And VR With UNITY Software	Robotic Process Automation
Data Analysis Using Python	Python And ML	Data Analysis With R
Mongo dB and NOSQL	Django And Python	Full Stack Development
DevOps Tools	Linux System Administration	Cloud Administration
Network Administration	Software Testing with Scrum	Software Project Management
Bigdata Using Spark/Hadoop	Excel And SQL For Data Analysis	AWS Cloud and DevOps
Azure Cloud and DevOps	Google Cloud and DevOps	Coding And Programming Skills
Android Application Development	IOS Application Development	NLP With Python
Social Media Analytics	JavaScript For Web Design	Micro Website Design Google Web Designer
Algorithms Thinking and Data Structures	UI Design	Storage System Management
Digital SEO/Sem Marketing	Web Services (Restful Services in Java, Etc.)	Digital Photography with Photoshop
Network Programming	WSN And IOT Programming	Image Processing Using Python
5G And IOT	Sentiment Analysis	Machine Learning And IOT
System Integration Tools	Computational Biology Using Python	C# And .Net
Kotlin Programming	Julia Programming	Objective C Programming
Java Script For Cyber Security	C++ Programming For Automotive Applications	E-Commerce Site Design
Banking And Insurance Using Python	MATLAB For Scientific Computing	Network Simulator NS3

Certification Programs		
EC Council: Certified Ethical Hacker	EC Council: CHFI Certified Hacking Forensics Investigator	Cisco: CCNP Security
CWNP: CWNS Certified Wireless Network Security Professional	ISACA: Certified Information Security Manager	Juniper: Juniper Network Certified Internet Professional
AWS: Certified Solutions Architect Professional	AWS: Certified DevOps Engineer	AWS: Certified Security Speciality
Google: Certified Professional Cloud Architect	Google: Associate Cloud Engineer	Red Hat: RHSCA in Red Hat OpenStack
Professional Cloud Developer	IBM: Certified System Administrator	IBM: Certified Database Administrator
PSC: Scrum Certification	Microsoft: Advanced MS Excel	PMI: PMP Certification
COBIT: IT Service Management Certification	VMWare: Advanced Certified Professional – Data Centre Virtualization	VMWare: Certified Professional Network Virtualization
IBM: Certified Application Developer	IBM: AI Certification	IBM: Data Science Professional Certificate
Wireshark: Certified Network Analyst	Cisco: CCNA Network Associate	Cisco: CCNP Enterprise
CWNP: WIFI administration	CWNP: Wireless Security Professional	Kubernetes and Red Hat OpenStack /AWS
VMWare: Certified Professional Cloud Management and Automation	Oracle: Business Intelligence	Oracle: Enterprise Management
Oracle: Virtualization	Red Hat: Micro services Certification	Block Chain Council: Blockchain Certification
DLA: Certified REST API Practitioner	Cloud Credential Council: IOT Certification	Microsoft: DevOps Engineer
Microsoft: Azure Data Engineer	Microsoft: Azure Administrator	Microsoft: Azure AI Engineer

Detailed Syllabus
Semester 1

Course Title	Multivariable Calculus and Linear Algebra				Course Type		Theory	
Course Code	B20AS0105	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course Differential Calculus deals with the basic aspect's differential calculus. The students of Computer Science are equally benefited with this course as stepping stone to the broad areas of calculus. This course familiarizes students with important concepts coming under differential calculus and to develop strong foundations on these concepts. In Computer Science, Calculus is used for machine learning, data mining, scientific computing, image processing, and creating the graphics and 3D visuals for simulations. Calculus is also used in a wide array software program that require it. Linear algebra provides concepts that are crucial to many areas of computer science, including graphics, image processing, cryptography, machine learning, optimization, graph algorithms, information retrieval and web search.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the scalar product and vector product of two or more vectors.
2. Illustrate how to find angle between polar curves with a suitable example.
3. Demonstrate the use of radius of curvature of the curves can be best suited for machine learning techniques with big data analytics.
4. Describe the concepts of Linear algebra and calculus theory.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply Taylor's and Maclaurin's series for finding series expansions of functions and approximating values. expansions of functions and approximating values.	1-6	1,2
CO2	Identify and evaluate the radius of curvature of the given curve. Also evaluate the given indeterminate form using L' Hospital rule.	1-6	1,2
CO3	Make use of Gauss elimination and Gauss Jordon method for solving the system of equations, if the given system of equations is consistent.	1-6	1,2
CO4	Determine the Eigen values, the corresponding Eigen vectors and diagonalizable the given square matrix.	1-6	1,2
CO5	Learn new tools and technologies in the linear algebra and apply for suitable application development.	12	1,2
CO6	Develop solutions in the linear algebra to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyse(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓		✓	
CO3			✓			
C04			✓			
CO5			✓			
CO6			✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1							3	3	
CO2	3	3	3	3	3	1							3	3	
CO3	3	3	2	2	3	1							2	2	
C04	2	3	2	3	3	1							1	1	
CO5												2	2	2	
CO6					2				2	2				2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT – 1 **Introduction to Vector Differentiation:** Introduction, Scalar and vector point functions, velocity, acceleration, Gradient, Divergence, Curl, Laplacian, Solenoidal and Irrotational vectors, Vector identities**.** **Differential Calculus-1**: Successive differentiation- nth derivatives of standard functions (no proof) simple problems, Leibnitz Theorem (without proof) and problems, Taylor's series and McLaurin's series expansion for function of one variable (only problems), Polar curves- Angle between the radius vector and the tangent, angle between two curves, Pedal equation for polar curves. Applications in computer science.
UNIT-2 **Differential Calculus-2:** Derivative of arc length – concept and formulae (without proof), Radius of curvature-Cartesian, parametric, polar and pedal forms (with proof) problems. Indeterminate forms and solution using L'Hospital's rule. Analysis of Randomized algorithms using Differential Calculus. Applications in computer science.
UNIT-3 **LinearAlgebra-1:** Basic concepts, Echelon form, normal form of a matrix, Rank of Matrix, Gauss-Jordon method to find inverse of a matrix, consistency of linear system of equations, Gauss elimination and Gauss-Jordon method to solve system of equations. Linear Algebra for statistics. Applications in computer science.
UNIT-4 **Linear Algebra-2:** Linear Transformations, orthogonal transformation, Eigen values and Eigen Vectors. Complex matrices, Similarity of Matrices, Diagonalization. Rayleigh power method to determiner largest Eigen value and the corresponding Eigen vector. Analysis of Randomized algorithms using Linear Algebra. Applications in computer science.

TEXT BOOKS:

1. Theodore Shifrin, "Multi-Variable Calculus and Linear Algebra with Applications", Wiley, 1st Edition, Volume 2, 2018.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition,2013.
4. Ron Larson, "Multivariable Calculus, Cengage Learning", 10th Edition, 2013.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Reprint edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2016.
3. Stanley I. Grossman, "Multivariable Calculus, Linear Algebra, and Differential Equations", 2nd Edition, Academic Press 1986.

JOURNALS/MAGAZINES

https://www.sciencedirect.com/journal/linear-algebra-and-its-applications

SWAYAM/NPTEL/MOOCs:

1. https://youtu.be/XzaeYnZdK5o
2. https://youtu.be/KSntcGOFdUc
3. https://youtu.be/LJ-LoJhbBA4

SELF-LEARNING EXERCISES:

1. Vectors in Space, Generalized Leibniz Rules, Mean Value of Derivatives, Powers of a matrix,
2. Testing of Linear Dependence and Independence and multivariate calculus. Introduction to differential equations.

Course Title	Basic Electrical and Electronics Engineering				Course Type		Integrated	
Course Code	B20EE0101	Credits	4		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	1	Theory Hours	Practical Hours	CIE	SEE
	Tutorial	-	-	-				
	Total	**4**	**5**	**4**	**39**	**26**	**50%**	**50%**

COURSE OVERVIEW

Basic Electrical & Electronics Engineering covers basic concepts of electrical engineering and electromagnetism. This course introduces the student to the working AC and DC Machines. It also helps the student to understand the basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes in rectifiers, filter circuits. Further, it has a self-learning component on BJT's.

COURSE OBJECTIVE (S):

1. Explain the basics of electrical and electronics engineering terminologies.
2. Distinguish the single and three phase systems.
3. Illustrate the different building blocks in digital electronics using logic gates and explain simple logic functions using basic universal gates.
4. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.
5. To build a broad concept for hands on experience in various types of electrical apparatus, tools and instrumentation with electrical safety norms.
6. To analyze the schematics for making electrical connection and to interpret experimental data for various electrical appliances.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the basics of electrical engineering terminology and the usage.	1-6	1
CO2	Analyze the concepts and applications of DC & AC Machines.	1-5	1
CO3	Apply the concept of domestic wiring, importance of safety and sensing devices	1-5,10	1
CO4	Analyze the different building blocks in digital electronics using logic gates and applications of diode in rectifiers, filter circuits and wave shaping.	1-5	1
CO5	Interpret, Identify and use appropriate electrical tools for electrical connections and to repair electrical equipment's.	1-7, 9,10	1,2
CO6	Compare experimental results with theoretical analysis and the ability to critically evaluate the performance of electrical appliances.	1-7, 9,10	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2				√		
CO3			√			
CO4				√		
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	1							1		
CO2	1	3	2	2	1								1		
CO3	2	2	2	2	1					2			1		
CO4	3	3	3	1	1								1		
CO5	2	2	1	3	1	3	1		3	1			3	3	
CO6	2	2	1	3	1	3	1		3	1			3	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:
THEORY:

CONTENTS
UNIT-1
Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Kirchhoff's Laws, Resistive, Inductive, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations, Network Theorems (Superposition, Thevenin's & Norton's) Generation of an alternating Emf–average and rms values of alternating quantity–representation of alternating quantities by phasors–single phase series and parallel circuits (simple problems), three phase systems and power calculations
UNIT-2
DC-Machines: Construction and Principle of operation of DC Machines–Emf & Speed equations-types–applications. AC-Machines: Principle of operation of single phase transformers–Emf equation–losses– efficiency and regulation-Construction and working principle of induction motors–Slip–torque characteristics–applications-Construction and Principle of operation of alternators applications.
UNIT-3
Instruments: Basic Principle of indicating instruments–PMMC&MI instruments. Tariff, Protective Devices and Sensors: Tariff schemes, basic concepts of domestic wiring and types, Earthing, protective fuses, MCB, sensors: pressure sensors, strain gage, proximity sensors, displacement sensors, Rotatory encoder and ultrasonic sensors and civil engineering applications.
UNIT-4
Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Light emitting diodes. Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Electrical Safety Training. a) To Study the importance of Earthing during accidental shorting of line wire and the body of equipment. b) To conduct experiment and to know the Importance and mechanism of FUSE c) To study the Importance and mechanism of MCB.	Trainer kit Ohms Law Fall of resistance	Importance & applications of Earthing, Fuse & MCB
2.	Home Electrical Wiring Demonstration. a) To study & verify the connection procedure for fluorescent lamp wiring. b) To study the connection of Fan with switch and regulator.	Fluorescent Lamp wiring Panel Fan with switch and regulator Kit	Connection & Trouble shooting of fluorescent lamp wiring & Fan with switch and regulator
3.	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring	Two-way switch or staircase wiring Kit	Connection, Working & application of Two-way switch
4.	Behaviour of current and voltage in series and parallel circuits. a) To study and verify the behaviour of current and voltage in series circuit. b) To study and verify the behaviour of current and voltage in parallel circuit.	Series and parallel circuits Kit	Connection & behaviour of current & voltage in series, parallel circuit
5	Polarity test on single phase transformer. a) To determine the additive polarity of a single-phase transformer. b) To determine the subtractive polarity of a single-phase transformer.	Transformer Kit	Polarities of single phase transformer
6	Determination of VI characteristics of Zener Diode	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
7	Determination of VI characteristics of Silicon Diode	VI characteristics of Silicon Diode kit	VI characteristics of Silicon Diode
8	Analyze the Half Wave and Full Wave rectifiers using Diode with and without filter	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor
9	Determine the Characteristics of BJT in Common Emitter Configuration	Characteristics of BJT in Common Emitter	Input & Output Characteristics of BJT
10	Determine the Characteristics of JFET in Common Source Configuration	Characteristics of JFET in Common	Input & Output Characteristics of JFET
11	Realization of Universal gates using basic logic gates.	Trainer kit	Universal gates will be realized using basic gates

TEXT BOOKS:

1. Nagrath I.J. and D. P. Kothari, “Basic Electrical Engineering”, Third Edition Tata McGraw Hill, 2009.
2. Hayt and Kimberly, “Engineering Circuit Analysis”, 8th Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., “Basic Electrical Engineering”, Tata McGraw Hill, 2009.
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall, India, 2009.
5. Hughes, E., “Electrical Technology”, Pearson, 2005.
6. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, 5th Edition, 2008.
7. D.P. Kothari, I. J. Nagrath, “Basic Electronics”, McGraw Hill Education (India) Private Limited, 2014.

REFERENCE BOOKS:

1. Theodore Wildi, “Electrical Machines, Drives, and Power, 5thSystems”, Pearson Edition, 2007.
2. Hughes, “Electrical Technology”, International Students 9th Edition, Pearson, 2005.

JOURNALS/MAGAZINES

1. International Journal of Electrical Power and Energy Systems (https://www.journals.elsevier.com/international-journal-of-electrical-power-and-energy-systems)
2. Journal of Electrical Engineering (https://link.springer.com/journal/202)

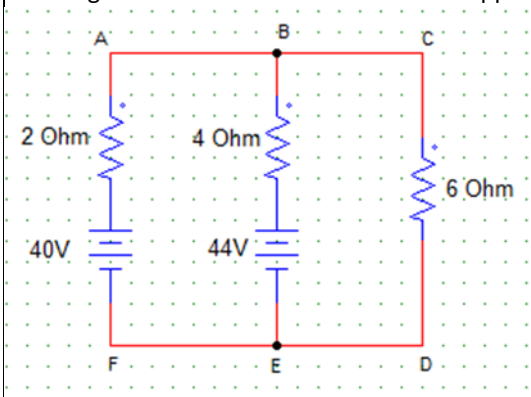
SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/108/108108076/

SELF-LEARNING EXERCISES:

1. Build an electrical circuit using BJT as a switch
2. Identifying the practical application of Electromagnetic Induction

PROBLEM BASED LEARNING

No	Problems
1	A current of 20A flows through two ammeter A and B in series. Potential difference across A is 0.2V and across B is 0.8 V. Find how the same current will divide between A and B when they are joined in parallel.
2	For the given circuit calculate the current supplied by each battery and current in 6 ohm resistor. 
3	Two 12V batteries with internal resistances 0.2 ohm and 0.25 ohm respectively are joined in parallel and a resistance of 1 ohm is placed across the terminals. Find the current supplied by each battery.
4	A 6 pole induction motor is connected to a 50 Hz supply. It is running at a speed of 970 R.P.M. Find the synchronous speed and the slip
5	If A= $(1011)_2$ and B = $(1110)_2$, perform the following arithmetic operations. i)Addition ii) subtraction ii) Multiplication
6	Simplify the given Boolean expression and implement using logic gates. i)Y=AB+ABC+AB(D+E) ii) Y=ABCD+ABD iii) Y=AB+A(B+C)+B(B+C)
7	Simplify the given Boolean Expression: i) Y= XY+XYZ+XY$\bar{Z}$+$\overline{XYZ}$ ii) $Y = \bar{A}\bar{B}$C+$\bar{A}$B$\bar{C}$+$\bar{A}$BC iii) Y= AC+C(A+$\bar{A}$B)
8	a) Perform the following operations: (i)Convert $(01110111)_2$ to decimal (ii) Convert $(21)_{10}$ to binary (iii) Add: $(1010)_2$ and $(0011)_2$ (iv) Subtract: $(111.111)_2$ from $(1010.01)_2$ (v) Divide: $(101101)_2$ by $(110)_2$

PROJECT BASED LEARNING

To enhance the skill set in the integrated course, the students are advised to execute course-based design projects. Some sample projects are given below:

	Suggested Projects
1.	Design & Development of a rectifier circuit
2.	Identify the types of wiring
3.	Electricity bill calculation
4.	Identify the types of motors used in domestic & industrial application with nameplate details.
5.	Identification of different transformer based on their rating used for various applications.

Course Title	Introduction to Python Programming				Course Type		Integrated	
Course Code	B20CI0101	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**3**	**4**	**4**	**26**	**26**	**50**	**50**

COURSE OVERVIEW:

Python is a Programming Language that can be treated in a procedural way, an object-orientated way or a functional way. It can be used on a server to create web applications, create workflows, connect to database systems, read and modify files, handle big data and perform complex mathematics. It can implement object oriented features and exception handling, It can parse the strings using regular expressions. It can be used for implementing the machine learning algorithms to develop solutions for interdisciplinary problems apart from any general problems leading to automation.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of python programming language constructs and their applications.
2. Inculcate knowledge of parsing of regular expressions and their usage in various application domains.
3. Gain expertise in Object oriented programming and NumPy package.
4. Discuss the files, Pandas and Data Virtualization concepts.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of language constructs to solve real world problems using python programming.	1- 4, 8, 9, 12	1
CO2	Develop programs for text processing and other application domains by making use of regular expressions.	1-3, 5,9,12	2
CO3	Apply features of object oriented and NumPy package to develop computationally intensive programming to analyze and interpret the data.	1- 5, 9, 12	3
CO4	Create data science solutions with the help of files, Pandas and Data Visualization.	1,4,5,9,12	1-3
CO5	Learn new tools and technologies in the python and apply for suitable application development.	12	1,2
CO6	Develop solutions in the python 1to the complex problems, either individually or as a part of the team and report the results with proper	5, 9, 10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1		3	
CO3	3	1	2	1	2				1			1			
CO4	3			2	2				1			1	3	3	3
CO5												1	2	2	
CO6					2				1	1				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Computer Fundamentals: Computer Components, accessories, specifications of computers and external devices. Flowchart symbols and guidelines, types and advantages, Algorithm design. **Python Fundamentals:** Introduction to Python: History, Applications, Your First Python Program, Constants, Variables, Naming conventions, simple data types, Type casting, Assignment statements, expressions, Boolean data type, Trigonometry functions, operators, precedence of operators, libraries, keywords, Python Collections, I/O statements, conditional statements, loops, functions, user defined functions. Introduction to GitHub and applications.
UNIT-2
Strings: Unicode, Formatting Strings, Format Specifiers, other Common String Methods, Slicing a String. Regular Expressions: Case Study: Street Addresses, Case Study: Roman Numerals, Checking for Thousands, Checking for Hundreds, Using the {n,m} Syntax, Checking for Tens and Ones.
UNIT-3
Object Oriented Programming: Defining Classes, The init() Method, Instantiating Classes, OOP features: Abstraction. Encapsulation, Single Inheritance, Polymorphism. Files: Reading from Text Files, Writing to text files, Reading and Writing the Binary Files.
UNIT-4
NumPy: Introduction to NumPy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output. Pandas and Data Visualization: Introduction, Series and Data Frames in pandas and Data Visualization.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			
1.	a). "LIST1" is a list that contains "N" different SRN of students read using a user defined function with the help of input () function. It is required to add SRN of "M" more students that are to be appended or inserted into "LIST1" at the appropriate place. The program must return the index of the SRN entered by user.	Windows/Linux OS, IDE, Jupiter	Create and perform operations on list.
	b) "TUPLE1" and "TUPLE2" are two tuples that contain "N" values of different data types read using the user defined function "READ" with the help of input() function. Elements of "TUPLE1" and "TUPLE2" are to be read one at a time and the "larger" value among them should be placed into "TUPLE3". Display all tuples.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on Tuples.
2.	a) SET1 and SET2 are two sets that contain unique integers. SET3 is to be created by taking the union or intersection of SET1 and SET2 using the user defined function Operation (). Perform either union or intersection by reading choice from user. Do not use built in functions union () and intersection () and also the operators "|" and "&".	Windows/Linux OS, IDE, Jupyter	Create and perform Union and Intersection, Operations on Sets.
	b) The Dictionary "DICT1" contains N Elements and each element in dictionary has the operator as the KEY and operand's as VALUES. Perform the operations on operands using operators stored as keys. Display the results of all operations.		Create dictionary and perform operation using user defined function.
3.	a) A substring "Substr" between index1 and index2 is to be extracted from the given input string "Str1", which is read using input(). Display the substring "Substr" using a user defined function if available in string "Str1", otherwise display NULL.	Windows/Linux OS, IDE, Jupyter	String operations.
	b) A string containing multiple words is to be read from the user one at a time, after reading perform following operations. Convert all the strings to uppercase and display Split the words of a string using space as the separation character and display.		
4.	a) Consider the text file, "Std.txt", with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, "Std.txt" and display the details of all the students of 4th Semester "A" Section who have scored more than 75%.	Windows/Linux OS, IDE, Jupyter	File Handling.
	b) Consider the text file "Emp.txt", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following: TOTAL_DEDUCTIONS= (LIC+PF) GROSS_SALARY= BASIC_SALARY+ DA NET_SALARY= GROSS_SALARY – TOTAL_DEDUCTIONS. Write the above data to file for each employee. Read the content of "Emp.txt" and display the details of each employee		File Handling.

5.	a). A “CAR” has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACUTING_YEAR and PRICE. A Class is required to be created for “CAR” to store the above attributes and perform the following operations: Get the details of “CAR” object from user and store into Array of objects Display the details of “CAR” object based on “COMPANY”, “MODEL” and “PRICE”.	Windows/Linux OS, IDE, Jupyter	Classes and objects usage.
	b). Airline Reservation System contains the attributes of passengers such as NAME, PAN_NO. MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for “Airlilne” with the above attributes and perform the following operations: Get the details of “Airline” object from user and store into Array of objects List details of all the passengers who travelled From “Bengaluru to London”. List details of all the passengers who travelled From “Chicago to Beijing” on 10th of Feb, 2020.		
6.	a). “Arr_1” is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the Diagonal elements of ”Arr_1” Elements of m^{th} row (row no should be entered by user) Elements of n^{th} column (column no should be entered by user)	Windows/Linux OS, IDE, Jupyter	NumPy arrays usability.
	b) The dictionary “DICT1” contains the pass percentage of each semester of B. Tech in CSE, where, “Semester” acts as the key and “Pass Percentage” acts as the value. A Python Pandas dataframe is required to be created using the dictionary “DICT1” and display it using a user defined function.		Pandas Series usability.
	Part-B (Mini Project: Library Management System)		
1.	Develop a program to create the class “USER” with the attributes USER_NAME, USER_ID, SCHOOL_NAME, ADDRESS, PHONE_NO, EMAIL_ID, DOB and AGE. The functions add user (), delete user (), edit user (), search user () should be part of the class. Instantiate “User” class with 10 objects. Read the attributes of each “User” object using input () and store them in the file “User_File.txt”.	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes of user and store them in a file.
2	Develop a program to get the name of the “User” object whose details are to be deleted. Read the “User_File.txt” and delete the “User” object if found. Display the contents of “User_File.txt” after	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes and
3	Develop a program to get the name of the “User” object whose details are to be edited (modified). Edit the details of the user object in the file “User_File.txt” and display the contents after	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
4	Develop a program to create the class “BOOK” with the attributes TITLE, AUTHOR, PUBLISHER, YEAR, PRICE, SCHOOL_NAME and the functions add book(), delete book(), edit book() and search book(). Instantiate “Book” class with 10 objects. Read the attributes of each “BOOK” object using input () and store them in the file	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes of user and store them in a file.
5	Develop a program to get the name of the “BOOK” object whose details are to be deleted. Read the “Book_File.txt” and delete the “BOOK” object whose details match with the data entered. Display the contents of “Book_File.txt” after deletion.	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes and delete the object.

6	Develop a program to get the name of the "BOOK" object whose details are to be edited (modified). Edit the details of the "Book" object in the file "Book_File.txt" and display the contents after modification.	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
7	Develop a program to create the class "TRANSACTION" with the attributes USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE and the functions issue book(), return book() and search book(). Instantiate "Transaction" class with 10 objects. Read the attributes of each "Transaction" object using input () and store them in the file "TransactionFile.txt". Develop a program to issue the book as requested by the user. Update the attributes in "Transaction _File"	Windows/Linux OS, IDE, Jupyter	Create class and perform string operations.
8	Develop a program to return the book. Edit the details of the user like USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE in "TransactionFile.txt" and display the contents after modification. Compute the fine amount to be paid if return date is not same as due date. If both return date and due date are same and put zero in fine amount.	Windows/Linux OS, IDE, Jupyter	Create class and perform string operation.
9	Develop a program to search for a book using its "author". Display the message "available" if search is successful otherwise display the message "not available".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
10	Develop a program to get a list of users by referring to "User_File.txt" and "Transaction_File.txt".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
11	Develop a program to get List of Books in stock by referring to "Book_File.txt" and "Transaction_File.txt".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
12	Develop a program to get List of Books Issued by referring to "User File", "Book File" and "Transaction File".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/Linux OS, IDE, Jupyter	Module integration and project

TEXT BOOKS:

1. Mark Pilgrim, "Dive into Python 3", Apress special edition, second edition, 20l5.
2. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers, 2006.

REFERENCE BOOKS:

1. A B Choudhary, "Flowchart and Algorithms Basics" Mercury Learning and Information,2020
2. Mark Lutz, "Learning Python", Oreilly. 2003.
3. John M. Zelle, "PYTHON Programming: An Introduction to Computer Science", Franklin, Beedle& Associates. 2004.
4. Michael Dawson, "Python Programming for the Absolute Beginners", 3rd Edition, CENAGE Learning.
5. Wesley J. Chun, "Core Python Programming", 2nd Edition, Prentice Hall.
6. Steve Holden and David Beazley, "Python Web Programming", New Riders, 2002. Springer, Kent D. Lee, "Python Programming Fundamentals", 2nd Edition.
7. John V. Guttag, "Introduction to Computation and Programming using Python", MIT Press, 2016.
8. https://www.tutorialspoint.com/computer_fundamentals/computer_fundamentals_tutorial.pdf

JOURNALS/MAGAZINES

1. https://www.codemag.com/Magazine/ByCategory/Python
2. http://ijaerd.com/papers/special_papers/IT032.pdf
3. https://iopscience.iop.org/article/10.1088/1742-6596/423/1/012027
4. https://ieeexplore.ieee.org/document/4160250

SWAYAM/NPTEL/MOOCs:

1. Coursera – Python for everybody, University of Michigan
2. Coursera – Python Basics, University of Michigan
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.edx.org/learn/python

SELF-LEARNING EXERCISES:

1. Explore PYTHON library for IOT programming
2. More exploration on GitHub
3. Data Visualization packages
4. C modules interface

<table>
<tr><td>Course Title</td><td colspan="4">Engineering Chemistry</td><td colspan="2">Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td>B20AS0104</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">I semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
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<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Engineering chemistry covers very relevant topics compatible with ECE, EEE and C&IT students and make them aware of importance of various aspects of basic science in engineering. The subject of Engineering chemistry covers area of light and matter interaction, clean energy storage and conversion devices, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the energy conversion and storage devices, which have become very attractive field of research in engineering stream. The subject deals with various engineering materials, their properties and applications in the field of engineering.

COURSE OBJECTIVE

The Engineering chemistry course is designed to fulfil the following objective;

1. Engineering chemistry covers the very basic knowledge required for engineering students to understand its importance of science in technology.
2. It provides the basic knowledge on Interaction of light and matter to know the electronic transitions in materials
   and storage and conversion devices.
3. Corrosion and metal finishing, explains the phenomenon of corrosion and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB
4. Polymers are all about the properties of various polymeric materials and their Commercial significance. The chapter reveals about technical and commercial Importance of composite materials.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the phenomenon of light and matter interaction to study the materials	1,2, 4,7,11	2
CO2	Demonstrate the electrode processes in Batteries and conversion devices.	6,11	2
CO3	Describe Corrosion phenomenon and precautions to be taken in the selection of materials in controlling corrosion, Fabrication of PCB and industrial applications.	2,4,7,11	2
CO4	Illustrate the properties of polymers, nano materials, composite materials and their applications in various fields.	1,2, 11,12	2
CO5	Learn new tools and technologies in the engineering chemistry and apply for suitable application development.	12	1,2
CO6	Develop solutions in the engineering chemistry to the complex problems, either individually or as a part of the team and report the results with proper analysis	5, 9, 10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyse (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√		√		
CO3		√	√			
CO4	√	√		√		
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		1			2				1			2	
CO2						2					2	3		2	
CO3	2	2		2		1	2							2	
CO4		2		2			2				3			2	
CO5												2	2	2	
CO6					2				2	2				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Light and matter interaction: Electro-magnetic spectrum-Applications in Engineering, Interaction of EM radiation with matter, work function of matter, Electrons in matter. Bonding theories: MOT, Band structure of matters HOMO-LUMO. Photochemical and thermal reactions: Laws of photochemistry, quantum yield, high and low quantum yield reactions. Jablonski diagram - photophysical and photochemical processes, photo-sensitization, photo- polymerization and commercial application of photochemistry.
UNIT-2
CLEAN ENERGY STORAGE AND CONVERSION DEVICES: Introduction to electrochemistry, basic concepts of Batteries and characteristics. Classification: Primary (Dry cell, Li-MnO2) and Secondary (Pb-acid, Li-ion) batteries. Super capacitors: classification, construction and applications in hybrid vehicles. Fuel cells: Alkaline fuel cells, Solid oxide fuel cells and phosphoric acid fuel cell. Photo-conversion devices: Photovoltaic cell, antireflective coating, panels and arrays. Production of single crystal semiconductor by Crystal pulling technique (Czochralski pulling technique), zone refining process (of Si). Problems: Calculation of energy and power density, capacity of a Battery and capacitance of super capacitors for electric vehicle applications.
UNIT-3
Corrosion: Electrochemical theory of corrosion, types of Corrosion- differential metal corrosion, differential aeration corrosion, boiler corrosion, and grain boundary corrosion, Corrosion studies on Al, Fe with pourbiax diagram, Factors affecting rate of corrosion-Primary, secondary. Corrosion control: Galvanizing & tinning, cathodic protection & Anodic Protection. **Metal Finishing:** Theory of electroplating, Factors required to study electroplating Effect of plating variables in electroplating process, Electroplating of gold (acid, neutral and alkaline cyanide bath). Electro less plating of copper and PCB manufacture by Electro less plating of copper. (Applications/case studies).
UNIT-4
CHEMISTRY OF ENGINEERING MATERIALS: Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in polyacetylene and polyaniline. Liquid crystals: Introduction classification and applications in electronic display devices. Nanomaterials: Introduction, classification based on dimensionality, quantum confinement. Size dependent properties- surface area, magnetic properties (GMR phenomenon), and thermal properties. Synthesis, Properties and applications of Fullerenes, CNT and Graphene. Sensors: Physical and chemical sensors, Biosensors for bioelectronic applications.

TEXT BOOKS:

1. R.V.Gadag & Nithyanandashetty,"Engineering Chemistry", Ik International Publishing house.
2. S.S. Dara ,"Text Book of Engineering Chemistry", S. Chand & Co.
3. S.S.Chawla ,"Text Book of Engineering Chemistry", Dhanpat Rai Pub.Co.

REFERENCE BOOKS:

1. P.W. Atkins,"Physical Chemistry", 5thedition Oxford.
2. Callister W.D., "Materials Science and Engineering", John Wiley & Sons.
3. R.Gopalan, D.\/enkappaya, S.Nagarajan,"Engineering Chemistry", Vikas Publication.

JOURNALS/MAGAZINES:

1. https://www.sciencedirect.com/journal/water-science-and-technology
2. https://iwaponline.com/wst
3. https://www.scitechnol.com/nanomaterials-molecular-nanotechnology.php
4. https://www.journals.elsevier.com/journal-of-energy-storage

SWAYAM/NPTEL/MOOCs

1. https://nptel.ac.in/courses/105/105/105105201/
2. https://nptel.ac.in/courses/112/108/112108150/

PROLEM BASED LEARNING

No	Problems
1	Calculation of wavelength and frequencies of the radiations
2	Calculation of band structure by HOMO and LUMO
3	Determination of cell potentials
4	Calculation of energy density and power density of a battery.
5	Determination of capacitance of a super capacitor
6	Crystal field stabilization energy

PROJECT BASED LEARNING

To enhance the skillset in the integrated course, the students are advised to execute course-based

Design projects.

Some sample projects are given below:

No.	Suggested Projects
1.	Collection of literature for the materials for the semi conducting applications
2.	Synthesis of a semiconductor materials for the electronic applications
3.	Construction of a PCB for the electronic device
4.	Synthesis of conducting polymers
5.	Synthesis of Energy storage materials
6.	Fabrication of efficient aqueous battery or super capacitor

<table>
<tr><td>Course Title</td><td colspan="4">Design Thinking</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20ME0102</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Design Thinking</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>13</td><td>26</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world. In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

COURSE OBJECTIVE:

1. To impart knowledge on design thinking process for understanding designs.

2. To provide design skills to analyze design thinking issues and apply the tools and techniques of design.

3. To inculcate attitude to solve societal problems using design thinking tools.

COURSE OUTCOMES (CO's):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the problems that fall under the purview of human centered design process for creative problem solving.	1,2, 9,10,12	1,2
CO2	Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques	1,2,9,10,12	2
CO3	Build simple prototypes for problems using gathered user requirements.	1,3, 9,10,12	1,2
CO4	Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.	1,4,8,9,10,12	1,2
CO5	Learn new tools, technologies and apply for suitable application development.	12	1, 2
CO6	Develop solutions to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2			✓			
CO3			✓			
CO4				✓		
CO5			✓			
CO6			✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	2	
CO2	1	3							2	3		2		2	
CO3	2		3						3	3		2	2	3	
CO4	2			2				1	3	2		2	2	3	
CO5												2	2	2	
CO6					2				2					2	2

Note: 1-Low, 2-Medium, 3-High

Course Content
Theory

Contents
UNIT-1
Design Thinking Process: Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc, identifying the target users for the problem selected, Survey on existing solutions for the problem identified. **Empathizing:** Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies.
UNIT-2
Defining the problems: POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc. **What is a prototype?** - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype **Prototyping for digital products:** What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

PRACTICE:

Sl. No	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human centered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop making problem statements from user perception
6	Presentation by student teams	PPT	Develop ability to express their views
7	Carry out Brain storming between the groups and generate as many as ideas possible	Ideation tools	Develop innovative mind set
8	Prototype for best 3 ideas selected	Sketching, simple model making etc	Develop prototyping techniques
9	Presentation by student teams	PPT	Develop ability to express their plan
10	Test the developed prototype with set of identified users	Google forms, cold calls, social media etc.	Develop understanding of various testing methods
11	Pitching final solution	PPT	Develop ability to express their views

TEXT BOOKS:

1. Gavin Ambrose, "Paul Harris, Basics Design-Design Thinking", AVA Publishing, 2010
2. Kathryn McElroy, "Prototyping for Designers: Developing the best Digital and Physical Products", O'Reilly, 2017.

REFERENCE BOOKS:

1. Michael G. Luchs, Scott Swan, Abbie Griffin, "Design Thinking – New Product Essentials from PDMA", Wiley, 2015.
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", 2012.

JOURNALS/MAGAZINES/ADDITIONAL SOURCES

1. Leonard, D., and Rayport, J. F. 1997. Spark Innovation through Empathic Design. In Harvard Business Review, November-December 1997, 102-113.
2. https://www.ideo.com
3. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking- process
4. https://www.ibm.com/design/thinking/page/toolkit
5. https://www.interaction-design.org/literature/article/define-and-frame-your-design- challenge- by-creating-your-point-of-view-and-ask-how-might-we
6. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
7. https://youtu.be/M66ZU2PCIcM
8. https://thisisdesignthinking.net/2017/07/innogy_energy_ecarsharing/

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/109/104/109104109/
2. https://nptel.ac.in/courses/110106124/

Course Title	Biology For Engineers				Course Type		Theory	
Course Code	B20AS0109	Credits	1		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**1**	**1**	**13**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Understanding biological systems, principles and concepts in order to create usable, tangible, economically viable product or process has become need of the hour. Hence irrespective of the parent engineering discipline, knowledge and expertise from pure and applied sciences is necessary to create product or process related to healthcare, agriculture, environmental issues and many more. Any engineer will have a high probability of using biology related skills and concepts to create products and processes beneficial to the mankind and as well for the sustainable environmental friendly approach. For example, the knowledge can be used to create medical devices, diagnostic equipment's, bioreactor designing, agriculture related equipment/instruments or anything related to surface science, fluid mechanism and polymer science. This course is designed to lay foundation in the field of Cell biology, Molecular biology and Genetics, so that anyone who is interested can design better product/process to enhance the overall quality of life.

COURSE OBJECTIVES:

1. To inculcate the basic concepts of biology from engineering perspective among students
2. To understand the interplay between biology and engineering disciplines
3. To conceptualize the engineering design/process/product for life science challenges

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the biology concepts from engineering perspective.	1	1
CO2	Apply the principles of Biology either for the process/product development from the engineering perspective.	1,2	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												2	
CO2	2	2											2	1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

CONTENTS
Introduction to Biology, Evolution and Origin of Life, Biomolecules-Lipids, Biomolecules: Carbohydrates, Water, Biomolecules: Amino acids, Proteins, Biomolecules: Enzymes, Biomolecules: Nucleotides, Cell structure and function – Prokaryotes, Cell structure and function – Eukaryotes, Cell cycle-Mitosis and Meiosis, Mendelian genetics: Mendelian inheritance, Genetic diseases and Mendelian inheritance, Central Dogma – Replication, Transcription and Translation.

TEXT BOOKS:

1. G.K. Suraishkumar, “Biology for Engineers”, Oxford University Press, 2019.
2. “Biology for Engineers: As per AICTE curriculum”, Wiley publication.
3. Dr.Sohini Singh, Dr.Tanu Allen, “Biology for Engineers”, Vayu Education of India.

REFERENCE BOOKS:

1. P.S.Verma and V.K. Agarwal, “Cell Biology, Genetics, Molecular Biology”, Evolution and Ecology , 2018.
2. Sambamurthy, ”Handbook of Genetics”, Friends Publisher, 2010 .

JOURNALS/MAGAZINES

1. Current Sciences

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
2. Coursera: Biology everywhere

SELF-LEARNING EXERCISES:

1. Case study: Computational biology in agriculture and Health Care
2. Artificial Intelligence in health care
3. Image processing for medical applications

PROBLEM BASED LEARNING

No.	Case Study
1	Case study: Computational biology in agriculture and Health Care
2	Case study: Artificial Intelligence in health care

Course Title	Computer Aided Engineering Drawing				Course Type		Integrated	
Course Code	B20ME0101	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	0	-	-				
	Total	**3**	**4**	**4**	**26**	**26**	**50**	**50**

COURSE OVERVIEW:

Engineering Graphics or drawing is known as language of engineers. All phases of engineering process require the conversion of new ideas and design concepts into the basic line language of graphics. There are many areas such as civil, mechanical, electrical, architectural, computer, electronics and industrial applications where knowledge and skills of the drawing play major roles in the design and development of new products or construction. This course emphasizes on projection of point, line, surfaces and solids. It also provides knowledge about representing the object in terms of 3d view and also development of the object.

COURSE OBJECTIVE (S):

1. To introduce the students to various concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient
2. To enable students to learn about the software tool to prepare engineering drawings
3. To teach the students about the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids
4. To communicate the concept/idea with others through the language of technical drawing and sketching.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the simple 2D drawings manually and also by using CAD software	1,5,10,12	1
CO2	Draw orthographic projection of point, line, plane surfaces and simple solids	1,3,5,10, 12	1
CO3	Draw sectional views of a prisms, pyramids, cone and cylinder	1,3,5,10, 12	1
CO4	Develop the lateral surfaces of the solids	1-3,5,10,	1,2,3
CO5	Create isometric view of the solids	1,3,5,10, 12	1
CO6	Develop solutions in the CAD to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4				√		
CO5				√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3					3		2	3		
CO2	3		2		3					3		2	3		
CO3	3		2		3					3		2	3		
CO4	3	2	2		3					3		3	3	3	2
CO5	3		2		3					3		3	3	2	1
CO6					2				2	2				2	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

CONTENTS
UNIT – 1 Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software. Orthographic projection of points in first and third Quadrant only. Orthographic projection of straight lines inclined to both horizontal and vertical planes. Orthographic projection of regular plane surfaces when the surface is inclined to both HP and VP.
UNIT-2 Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.
UNIT-3 Sections of solids – Drawing sectional views and true shape of section, Development of surfaces- Parallel line method for prisms and cylinders, Radial line method for pyramids and cones.
UNIT-4 Isometric projections of simple and combined solids.

PRACTICE:

No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analyzing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
6.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	interpretation and software skill
7.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	interpretation and software skill
8.	Draw the projection of cone and cylinder inclined to both HP and VP	Solid Edge Software	interpretation and software skill
9	Draw the projection of section of solids in simple position	Solid Edge Software	analyzing and software skill
10	Develop the lateral surface of prisms and cylinder	Solid Edge Software	Creative and software skill
11	Develop the lateral surface of pyramids and cone	Solid Edge Software	Creative and software skill
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analyzing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analyzing and software skill

TEXT BOOKS:

1. K. R. Gopalakrishna, “Engineering Graphics”, Subhas Publications, 2012.
2 Bhatt N.D., Panchal V.M. & Ingle P.R., “Engineering Drawing”, Charotar Publishing House, 2014.

REFERENCE BOOKS:

1. Luzadder and Duff, “Fundamental of Engineering Drawing”, Prentice hall of India Pvt Ltd. 11th Edition, 2001.
2. Shah, M.B. & Rana B.C., “Engineering Drawing and Computer Graphics”, Pearson Education, 2008.

SWAYAM/NPTEL/MOOCS:

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://www.udemy.com/course/ed/

PROBLEM BASED LEARNING

Sl. No	Problems
1	A point 30 mm above XY line is the front view of two points A and B. The top view of A is 40 mm behind VP and the top view of B is 45 mm in front of VP. Draw the projections of the points and state the Quadrants in which the points are situated.
2	A point 'A' is 30 mm in front of VP & 40 mm above HP. Another point B is 20 mm behind VP & 35 mm below HP. The horizontal distance between the points measured parallel to XY line is 60 mm. Draw the three projections of the points. Join their front and top views.
3	A point P is on HP and 35 mm in front of VP. Another point Q is on VP and below HP. The line joining their front views makes an angle of 300 to XY line, while the line joining their top views makes an angle of 450 with XY line. Find the distance of the point Q from HP.
4	A point is 35 mm below HP, 20 mm behind VP and 25 mm behind / in front / from RPP. Draw its projections and name the side view.
5	A line AB 80 mm long is inclined to HP at 30 degree and inclined to VP at 45degree. Draw front and top views of line and determine their lengths. Also, measure the perpendicular distance of end B from both HP & VP.
6	A line AB has its end A 20 mm above the HP and 30 mm in front of VP. The other end B is 60 mm above HP and 45 mm in front of VP. The distance between end projectors is 70 mm. draw its true length and apparent inclinations.
7	The top view pq of a straight line is 70 mm and makes an angle of 60 degree with XY line. The end Q is 10 mm in front of VP and 30 mm above HP. The difference between the distances of P and Q above HP is 45 mm. draw the projections. Determine its true length and true inclinations with HP
8	The top view of a line 75 mm long measures 50 mm. The end P is 30 mm in front of VP and 15 mm above HP. The end Q is 15 mm in front of VP and above HP. Draw the projections of the line and find its true inclinations with HP and VP.
9	The distance between the end projectors through the end points of a line AB is 60 mm. the end A is 10 mm above HP and 15 mm in front of VP. The end B is 35 mm in front of VP. The line AB appears 70 mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP and VP.
10	The point B of a line AB is on the horizontal plane, the top view of the line makes an angle of 30 degree with XY line, being 80mm. the point A is on the vertical plane and 50 mm above the horizontal plane. Draw the top and front views of the line and obtain the true length of the line. Also find the inclinations of the line with two planes.
11	The end A of a line AB is in HP and 25 mm in front of VP. The end B is 10 mm in front of VP and 50 mm above HP. The distance between the end projectors when measured parallel to the line of intersection of HP and VP is 80 mm, Draw the projection of the line AB and determine its true length and true inclination with HP and VP.
12	Find the true length and true inclination of a line AB with HP having one of its ends 20 mm in front of VP and 30 mm above the HP. The line is inclined at 40 degree to VP and left side view of the line is 60 mm long and inclined at 60degree to the x1y1 line. Draw all the three views of the line.
13	An equilateral triangular lamina of 25mm side lies with one of its edges on HP such that the surface of the lamina is inclined to HP at 60degree. The edge on which it rests is inclined to VP at 60degree.
14	A 30 degree-60degree setsquare of 60mm longest side is kept such that the longest side is in HP, making an angle of 30 degree with VP. The set square itself is inclined at 450 to HP. Draw the projections of the setsquare.
15	A square lamina ABCD of 40mm side rests on corner C such that the diagonal AC appears to be at 45 degree to VP. The two sides BC and CD containing the corner C make equal inclinations with HP. The surface of the lamina makes 30 degree with HP. Draw its top and front views.
16	A mirror 30 mm x 40 mm is inclined to the wall such that its front view is a square of 30 mm side. The Longer sides of the mirror appear perpendicular to both HP and VP. Find the inclination of the mirror with the wall.

Sl. No	Problems
17	A pentagonal lamina of sides 25 mm is resting on one of its edges on HP with the corner opposite to that edge touching VP. This edge is parallel to VP and the corner, which touches VP, is at a height of 15 mm above HP. Draw the projections of the lamina and determines the inclinations of the lamina with HP and VP and the distance at which the parallel edge lies from VP.
18	A pentagonal lamina of sides 25 mm is having a side both on HP and VP. The corner opposite to the side on which it rests is 15 mm above HP. Draw the top and front views of the lamina.
19	Draw the top and front views of a hexagonal lamina of 30mm sides having two of its edges parallel to both vertical and horizontal planes and one of its edges is 10 mm from each of the planes of projection. The surface of the lamina is inclined at an angle of 60° to the HP.
20	A hexagonal lamina of sides 30 mm has one of its comers in VP and its surface inclined at an angle of 30° with VP. The diagonal passing through that corner which is in VP appears to be inclined at 45° to HP. Draw the projections of the lamina.
21	A hexagonal lamina of sides 25 mm rests on one of its corners on HP. The corner opposite to the corner on which it rests is 35mm above HP and the diagonal passing through the corner on which it rests is inclined at 30° to VP. Draw its projections. Find the inclination of the surface with HP.
22	Draw the projections of a circular plate of negligible thickness of 50 mm diameter resting on HP on a point A on the circumference, with its plane inclined at 45° to HP and the top view of the diameter passing through the resting point makes 60° with VP.
23	A circular lamina inclined VP appears in the front view as an ellipse of major axis 30 mm and minor axis 15 mm. The Major- axis is parallel to both HP and VP. One end of the minor axis is in both the HP and VP. Draw the projections of the lamina and determine the inclination of the lamina with the VP.
24	A square prism 35mm side of base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30º. Draw the projections of the prism when the axis is inclined to HP at
25	A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to HP at 40° & VP at 30º
26	A Hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges. Draw the projections of the prism when the axis is inclined to HP at 45° & appears to be inclined to VP
27	A cone 40 mm diameter and 50 mm axis is resting on one generator on HP which makes 30° inclination with VP. Draw its projections.
28	A pentagonal pyramid 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30º. Draw the projections of the pyramid when the axis is inclined to HP at 45º
29	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.
30	A vertical cylinder of base diameter 50 mm and axis 65 mm long rests on HP. It is cut by a section plane perpendicular to VP, inclined at 45 degree to HP and at a height of 30mm from the base. Draw its sectional top view and true shape of the section.
31	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.
32	A square pyramid base 40mm side and axis 65mm long has its base on HP and all the edges of the base are equally inclined to VP. It is cut to with an inclined plane so as the truncated surface at 45 degree to axis, bisecting it. Draw the development of the truncated pyramid.
33	A Hexagonal prism of base side 30mm and axis length 60mm resting on HP in such a way that two of its edges are parallel to VP. The prism is cut by a section plane which is perpendicular to the VP and inclined at 30º to the HP at a height of 35mm from the base. Draw the development of the lateral surface of the prism.

Sl. No	Problems
34	A pentagonal prism, 30 mm base side & 50 mm axis is standing on HP on its base whose one side is perpendicular to VP. It is cut by a section plane 45 degree inclined to HP, through mid-point of axis. Draw FV, sectional top view& sec. Side view. Also draw true shape of section and Development of surface of remaining solid.
35	A hexagonal pyramid 25mm side of base and axis 65mm long is resting on its base on HP with one of the edged of the base parallel to VP. It is cut by a section plane inclined at 60º to HP and perpendicular to VP and intersecting the axis at 30mm above the base. Draw the development of the remaining portion of the pyramid.
36	A cone of base diameter 40 mm and height 50 mm is placed centrally on the top of a square slab side 60 mm and height 25 mm. Draw the isometric projection of the combination.
37	A sphere of diameter 45mm rests centrally over a frustum of cone of base diameter 60mm, top diameter 40mm and height 50mm.Draw its isometric projections.
38	A cube of 35 mm placed centrally on a square slab of 50 mm and thickness 30 mm. Draw the isometric projection of the combination.
39	Draw the isometric projection of the combination. Draw isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 40mm as diameter and altitude 50mm, resting on its top such that the axes of both the solids are collinear.
40	A rectangular pyramid of base 40mmx25mm and height 50mm is placed centrally on a rectangular slab side 100mmx60mm and thickness 20mm.Draw the isometric projection of the combination.

PROJECT BASED LEARNING

To enhance the skill-set in the integrated course, the students are advised to execute course-based design projects. Some sample projects are given below:

No.	Suggested Projects
1.	Model making of different solids by using Hardbound sheet.
2.	Using Hardbound sheet, prepare the different solids models by development and section methods.
3.	Prepare a demo model to show the principle of orthographic projection.
4.	Prepare the models for showing the method of Isometric projection.
5.	Problem based on Practical approach in view of orthographic projection of lines and planes.
6.	Collection or Interpretation of Engineering Drawing sheets Related to Manufacturing, Civil construction, Layouts, Plans and other Applications.
7.	Study on Comparison of 3D views and isometric Views.
8.	Drawing the Plan of students Home or building (2D)

Detailed Syllabus
Semester 2

Course Title	Probability and Statistics				Course Type		Theory	
Course Code	B20AS0204	Credits	4		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	-	-	-	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**4**	**4**	**4**	**52**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course Probability and Statistics for Computer Science treats the most common discrete and continuous distributions, showing how they find use in decision and estimation problems, and constructs computer algorithms for generating observations from the various distributions. Probability in the design and analysis of randomized algorithms. Common randomized algorithms are things like Quicksort and Quick select. Probabilistic method can also useful to prove various important results. Probabilistic methods used to prove some partition theorems that were then used to create efficient data structure.

COURSE COBJECTIVE (S):

The objectives of this course are to:

1. Describe Curve fitting and regression in various problems in Computer Science & engineering fields
2. Illustrate the applications of Probability and statistics in various computer science engineering Fields like data mining, classification problems etc.
3. Discuss Sampling theory concepts to solve various engineering problems like structured and unstructured Data models
4. Demonstrate Stochastic problem as Markov model as a problem solving methods for systematic model buildings.
5. Learn new algorithms and methods in probability and statistics and apply for suitable problem solving methods.
6. Create solutions for problem solving methods using algorithms to the complex problems, either individually Or as a part of the team and report the results with proper analysis.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve the problems of Curve fitting and regression in various problems in Computer Science & Engineering fields.	1-6	1,2
CO2	Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.	1-6	1,2
CO3	Develop a stochastic problem as Markov model as a problem solving methods for systematic model buildings.	1-6	1,2
CO4	Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.	1-6	1,2
CO5	Learn new algorithms and methods in probability and statistics and apply for suitable problem solving methods.	1-6	1,2
CO6	Create solutions for problem solving methods using algorithms to the complex problems, either individually or as a part of the team and report the results with proper analysis.	1-5,9	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓		✓	
CO3			✓			
C04			✓	✓		
C05		✓				
C06			✓			

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	3	1							3	3
CO2	3	3	3	3	3	1							3	3
CO3	3	3	2	2	2	1							2	2
CO4	2	3	2	2	3	1							1	1
CO5	3	3	2	2	1	1							2	1
CO6	2	3	3	3	1	1							2	1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT – 1 Curve Fitting: Curve fitting by the method of least squares and fitting of the curves of the form, *y = ax + b, y = ax2 + bx + c, y = aebx and y = axb* Statistical Methods: Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression, problems. Rank correlation. Applications in computer science
UNIT – 2 Probability distributions: Recap of probability theory (definition, addition rule, multiplication rule, conditional probability). Random variables, Discrete and continuous probability distributions. Binomial, Poisson, exponential and normal distributions (derivation of mean and variance for all distributions). Applications in computer science.
UNIT – 3 Joint Probability distribution: Joint Probability distribution for two discrete random variables (both discrete and continuous cases), expectation, covariance, correlation coefficient. Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. Applications in computer science.
UNIT – 4 Sampling theory:-Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications in Computer Science.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. ErwinKreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2013.
3. Seymour Lipschutz, John J. Schiller., "Schaum's Outline of Introduction to Probability and Statistics" McGraw Hill Professional, 1998, pp. 256.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th print edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2016.
3. V.Sundarapandian, "Probability, Statistics and Queuing theory", PHI Learning, 2009
4. Dr. B. Krishna Gandhi, Dr. T.K.V. Iyengar, Dr. M.V.S.S.N. Prasad&S. Ranganatham. "Probability and Statistics", S. Chand Publishing, 2015.
5. J. K. Sharma "Operations Research theory and applications", Macmillan publishers, fifth

JOURNALS/MAGAZINES

1. https://www.hindawi.com/journals/jps/
2. https://www.journals.elsevier.com/statistics-and-probability-letters
3. http://www.isoss.net/japs/

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/browse/data-science/probability-and-statistics
2. https://nptel.ac.in/courses/111/105/111105041/
3. https://onlinecourses.swayam2.ac.in/cec20_ma01/preview

SELF-LEARNING EXERCISES:

1. Curve fitting for application problems, Regression analysis for a bivariate data.
2. Probability distribution- Geometric, gamma- distributions, Joint probability distributions of continuous random variables.
3. Sampling analysis of real time problems. Applications to computer science: Data Mining, classification problems etc.

Course Title	Physics for Computer Science				Course Type		Theory	
Course Code	B20AS0106	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50**	**50**

COURSE OVERVIEW

This course introduces the basic concepts of Physics and its applications to Computer Science Engineering courses by emphasizing the concepts underlying four UNITs: Wave Mechanics, Lasers and optical fibers, EM wave and spectrum, Display Technology and Quantum computation. The subject has basic laws, expressions and theories which help to increase the scientific knowledge to analyze upcoming technologies.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Impart the knowledge about wave mechanics, electromagnetic waves, and its applications
2. Demonstrate the different applications of lasers, and optical fibers
3. Discuss different types of display technologies, touch screen techniques and its applications
4. Explain the importance of quantum computation as an emerging technology.
5. Learn new tools and technologies Physics and its applications to Computer Science Engineering and Apply for suitable technologies.
6. Increase the scientific knowledge to analyze upcoming technologies.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply knowledge of wave mechanics, its importance, and applications	1-4	1
CO2	Classify EM waves based on the frequency range, optical fibers and derive expression for NA, number of Modes and attenuation.	1-4	1
CO3	Summarize capacitive and resistive Display Technologies.	1-4	2
CO4	Analyze the working and application of quantum computation	1-3	1
CO5	Learn new tools and technologies Physics and its applications to Computer Science Engineering and apply for suitable technologies.	1-4	2
CO6	Increase the scientific knowledge to analyze upcoming technologies.	1-3	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			√			
CO2		√				
CO3		√				
CO4			√			
CO5		√	√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1									3		
CO2	3	3	2	1									3		
CO3	3	3	2	1										3	
CO4	3	2	1										3		
CO5	3	2	2										3		
CO6	3	2	2										3		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Wave mechanics: Introduction to Wave mechanics, De-Broglie hypothesis. Expression for de-Broglie wavelength of an electron in terms of accelerating potential. Phase velocity and group velocity, Relation between phase velocity and group velocity. Quantum Physics: Wave function, properties of wave function and physical significance. Probability density and Normalization of wave function, Schrodinger time- dependent and independent wave equation, Eigen values and Eigen functions. Applications of Schrödinger wave equation – energy Eigen values of a free particle, Particle in one dimensional infinite potential well with numerical examples. Application-Quantum computation.
UNIT-2
Lasers: Lasers Interaction between radiation and matter (induced absorption, spontaneous and stimulated emission). Expression for energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser operation (population inversion and Meta stable state). Requisites of laser system, semiconductor laser and its applications. Electromagnetic Waves: Basic idea of displacement current, Electromagnetic waves, their characteristics, Electromagnetic spectrum (7 types of EM waves) including elementary facts. Uses of EM waves in communications.

UNIT-3
Optical fibers: Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of core and cladding refractive indices, Condition for wave propagation in optical fiber, V-number and Modes of propagation, Types of optical fibers, Attenuation and reasons for attenuation, Applications: Explanation of optical fiber communication using block diagram, Optical source (LED) and detector (Photodiode) and their applications. Advantages and limitations of optical communications.
UNIT-4
Display technology: Touch screen technologies: Resistive and capacitive touch screen and Displays: CRT, Field emission display, Plasma display, LED display, OLED display, LCD display. Quantum Computation: Quantum wires (one dimensional), Quantum dots (zero dimensional); the idea of "qubit" and examples of single qubit logic gates- Classical bits, Qubit as a two-level system.

TEXT BOOKS:

1. William T. Silfvast, "Laser Fundamentals", Cambridge University press, New York, 2004
2. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley and Sons, New York, 10th edition 2013
3. R. K. Gaur and S.L. Gupta, "Engineering Physics", DhanpatRai Publications (P) Ltd, New Delhi. 53rd edition, 2014.
4. M.N. Avadhanulu and P.G. Kshirsagar, "A textbook of Engineering Physics", S. Chand and Company, New Delhi, 2014.
5. EM Waves and Fields: P. Lorrain and O. Corson.

REFERENCE BOOKS:

1. Charls Kittel, "Introduction to Solid State Physics", Wiley, Delhi,8th Edition, 2004
2. Arthur Beiser, "Concepts of modern Physics", Tata McGraw Hill publications, New Delhi, 8th Edition, 2011.
3. S. O. Pillai, "Solid State Physics", New Age International publishers, New Delhi, 2010
4. Chen, Wayne Cranton, Mark Fihn, "Handbook of Visual Display Technology", Springer Publication, Second edition 2012.

JOURNALS/MAGAZINE

1. https://www.codemag.com/Magazine/ByCategory/Python
2. http://ijaerd.com/papers/special_papers/IT032.pdf
3. https://iopscience.iop.org/article/10.1088/1742-6596 / 423 / 1 / 012027
4. https://ieeexplore.ieee.org/document/4160250
5. Python for scientific computing

SWAYAM/NPTEL/MOOCs:

1. https://www.mooc.org/
2. https://www.coursera.org/

Course Title	Introduction to Data Science				Course Type		Integrated	
Course Code	B20CS0101	Credits	3		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**3**	**4**	**4**	**26**	**26**	**50%**	**50%**

COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: Set Theory, Probability theory, Tools for data science, ML algorithms and demonstration of experiments by using MS-Excel.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Illustrate the use of basic concepts of Data Science in the real world applications.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Data Science in developing the real world applications.	1-4,11	1,2
CO2	Apply the SQL commands in developing the real-world applications.	1,2	2, 3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1-4	1, 2, 3
C04	Create the real world AI based solutions using different machine learning algorithms	1-4	1, 2
C05	Learn new tools and technologies in Data Science and apply for suitable application development.	1-5	1,2
C06	Develop solutions in the Data Science to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1-3	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓			
CO3			✓	✓		
C04			✓	✓	✓	✓
C05		✓	✓			
C06			✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2							3	3	3	3	
CO2	2	2									2	2		3	3
CO3	3	3	3	3							3	3	3	3	2
C04	3	3	3	3							3	3	3	3	
C05	3	3	3	3									3	3	
C06	3	3	3	1									3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Microsoft Excel Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Filters, Grouping. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel. Import XML Data into Excel How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.
UNIT-2
Introduction to Data Science What is Data Science? Probability theory, Bayes theorem, Bayes probability; Cartesian plane, equations of lines, graphs; exponents. **Introduction to SQL** SQL: creation, insertion, deletion, retrieval of Tables by experimental demonstrations. Import SQL Database Data
UNIT-3
Data science components Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Description of linear regression and Logistic Regression. Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.
UNIT-4
Data visualization using scatter plots, charts, graphs, histograms and maps Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data **Applications of Data Science** Data science life cycle, Applications of data science with demonstration of experiments either by using Microsoft Excel.

PRACTICE:

<table>
<tr><th>No</th><th>Title of the Experiment</th><th>Tools and Techniques</th><th>Expected Skill/Ability</th></tr>
<tr><td>1</td><td>The height (in cm) of a group of fathers and sons are given below, Find the lines of regression and estimate the height of son when the height of father is 164 cm.

Plot the graph.
Hgt of Fathers: 158 166 163 165 167 170 167 172 177 181
Hgt of Sons: 163 158 167 170 160 180 170 175 172 175</td><td>MS Excel</td><td>Create and perform operations on Excel data set by applying Linear regression</td></tr>
<tr><td>2</td><td>Using the data file DISPOSABLE INCOME AND VEHICLE SALES, perform the following:
Plot a scatter diagram.
Determine the regression equation.
Plot the regression line (hint: use MS Excel's Add Trend line feature).
Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900.
Compute the coefficient of determination and the coefficient of correlation</td><td>MS Excel</td><td>Perform prediction and visualization of data</td></tr>
<tr><td>3</td><td>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.
Plot a scatter diagram.
Determine the regression equation.
Plot the regression line (hint: use MS Excel's Add Trend line feature).
Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
Compute the coefficient of determination and the coefficient of correlation</td><td>MS Excel</td><td>Perform prediction and visualization of data</td></tr>
<tr><td>4</td><td>Apply multiple linear regression to predict the stock index price which is a

year | month | interest rate | unemployment rate | stock index price
2020 | 10 | 2.75 | 5.3 | 1464</td><td>MS Excel</td><td>Perform prediction and visualization of data</td></tr>
<tr><td>5.</td><td>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10, 00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for a loan availed of Rs.10, 00,000 during 3 years.

Sl No. | A | B
1 | Principal | Rs.10,00,000
2 | Annual interest rate | 5.20%
3 | Year of the loan | 3
4 | Starting payment number | 1
5 | Ending payment number | 36
6 | total interest paid during period | ?</td><td>MS Excel</td><td>Create Excel data and perform EMI estimator</td></tr>
</table>

6	Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO, should not be NULL.	SQL	Creating Tables
7	Create the customer database of a big Market with CUSTOMER_ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_CODE. Store at least twenty customer's details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.	SQL	Creating and retrieving Tables
8	Apply linear regression to find the weather (temperature) of a city with the amount of rain in centimeters. Create your own database with following details. CITY Temperature in Centigrade Rain in Centimeters	MS Excel	Apply Linear regression
9	Use the linear regression technique to compare the age of humans with the amount of sleep in hours. Name Age in Years Sleep in hours Create your own database with above details.	MS Excel	Apply Linear regression
10	Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.	MS Excel	Apply Linear regression
11	Design the ER diagram and create schema of the REVA library management system.	Entity Relationship	Entity Relationship
12	Design the ER diagram and create schema for Hospital Management system.	Entity Relationship	Schema design

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 43nd edition, 2015.
2. Ramakrishnan and Gehrke, “Database Management systems”, Third Edition, McGraw Hill Publications, 2003.
3. Mastering Data Analysis in Excel - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, “Data Analysis with Microsoft Excel”, S. Chand & Company, 2004.

REFERENCE BOOKS:

1. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Publications, 19th edition, 2013.
2. ErwinKreyszig, “Advanced Engineering Mathematics”, Wiley Publications, 9th edition, 2013.
3. Seymour Lipschutz, John J. Schiller, “Schaum's Outline of Introduction to Probability and Statistics”, McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060 - International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253 -IEEE Magazine on Big data & Analytics

SWAYAM/NPTEL/MOOCs:

1. Excel Skills for Business: Essentials, Macquarie University (https://www.coursera.org/learn/excel-Essentials)
2. SQL for Data Science, University of California, Davis (https://www.coursera.org/learn/sql-for-data-science)
3. Data Science Math Skills, Duke University (https://www.coursera.org/learn/datasciencemathskills)
4. https://www.edx.org/course/subject/data-science
5. https://onlinecourses.nptel.ac.in/noc19_cs60/preview

SELF-LEARNING EXERCISES:

1. Relational database management system.
2. Advanced MS-Excel

Course Title	Basics of Civil and Mechanical Engineering				Course Type		Integrated	
Course Code	B20CE0201	Credits	4		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2				
	-	-	-	-	Theory	Practical	IA	SEE
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW

This course introduces the Mechanical and Civil Engineering concepts, underlying the fact that this knowledge is essential for all Engineers. The students are made to understand the concept of internal combustion engines and power transmission systems. The students are also exposed to the knowledge of mechanical machine tools with its operations on lathe, drilling, and CNC machines. The students are introduced to the domain of fabrication processes like Soldering, Welding and 3D printing technology. Along with this student are made to expose to scope of Civil engineering, role of civil engineers in different infrastructure & economic development of the country. Students will learn about basic concept of forces, friction, centroid and moment of inertia.

COURSE OBJECTIVE

This course enables graduating students

1. To develop the basic knowledge of IC engines, refrigeration-air conditioning and power Transmission systems.
2. To incorporate the concepts of manufacturing processes using different machine tools, welding Techniques, CNC and 3D printing technology.
3. To understand a broad concept of engineering mechanics.
4. To develop the basics of composition of coplanar forces and fluid mechanics
5. Learn concept of internal combustion engines and power transmission systems
6. Introduction to the domain of fabrication processes like Soldering, Welding and 3D printing technology.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the fundamentals of IC engines, refrigeration-air conditioning and power transmission systems.	1,2	3
CO2	Explain the manufacturing processes using lathe, drilling, welding, CNC machines and 3D printing technology	1,2	3
CO3	Describe the moment of force and couples and equivalent force-couple system.	1,2	3
CO4	Solve numerical problems on composition of coplanar concurrent and non-concurrent force system and basics of fluid mechanics	1,2	3
CO5	Learn concept of internal combustion engines and power transmission systems	1,2	1
CO6	Introduction to the domain of fabrication processes like Soldering, Welding and 3D printing technology.	1,5	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2		✓				
CO3	✓	✓	✓	✓	✓	
C04	✓	✓	✓			
C05		✓				
C06		✓				

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													1
CO2	3	2													1
CO3	3	2													1
C04	3	2													1
C05	3	2													1
C06	3	2													1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Mechanical Engineering: Overview of Mechanical Engineering, Importance and applications of Mechanical Engineering in different fields. Thermal Energy Systems: Introduction to IC Engines, Classification, parts of IC Engine, working of 4-stroke Petrol engine with PV-diagram. Simple numerical on calculation of IP, BP and Mechanical efficiency, Introduction to refrigeration system, working of vapour compression refrigeration and window spit air conditioning system. Applications of refrigeration systems
UNIT-2
Power Transmission System: Introduction to drives, classification, belt drives (open and crossed-No derivations) and gear drives and types of gear, Numerical on gear drives. Mechanical Machine Tools: Introduction- lathe, classification, major parts of engine lathe, operations, Drilling machine, classification working bench drilling machine and operations, CNC Machines-Block diagram and applications. Introduction to 3D Printing technology Joining processes-Welding: Working of electric arc welding and soldering, Differences between welding and
UNIT-3
Introduction to Civil Engineering: Scope of Civil Engineering, Types of Infrastructure, Effect of Infrastructure facilities, Role of Civil Engineers in the Infrastructure and Economic Development of Country. Introduction to Engineering Mechanics: Basic concepts, Newton laws of Motion Elements of force, system of forces, principles of physical Independence, superposition and Transmissibility of forces. Moment of force –Couple, Moment of couple and its characteristics, Equivalent Force – Couple system. Resolution and composition of forces. Coplanar Concurrent Force System: Parallelogram Law of forces, principle of resolved parts, composition of
UNIT-4
Coplanar Non – concurrent forces: Varignon's principle of Moments, Resultant of Non – Concurrent force systems, Equilibrium of Coplanar Concurrent Force System: Type's forces acting on the body, free body diagrams, Equations of Equilibrium, Lami's theorem, Equilibrium of Non – concurrent forces equilibrium equations Friction: Frictional forces, Law of friction, Angle of friction, Angle of Repose and Cone of Friction (Theory only) Centroid: Center of Gravity, Center of Gravity of Flat Plate, Centroid, difference between Center of gravity and Centroid, Uses of Axis Symmetry, simple problems Moment of Inertia: Moment of Inertia of Plane Figure, Polar Moment of Inertia and Moment of Inertia of Standard sections (Derivations not included). Simple problems. Fluid Mechanics: Introduction, methods of describing fluid motion, definitions of types of fluid flow, streamline, path line, stream tube. General Continuity equation (problems).

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Dismantling and Assembly of 2-Wheeler (2–stroke) Engine	2-Stroke Engine (TVS Bike)	Hands on Experience
2	Study of Fitting tools and preparation of fitting model (1 Model)	Fitting tools	Hands on experience
3.	Study of sheet metal tools and development of Cylinder (1 Model)	Sheet metal tools and soldering tools	Hands on experience
4.	Study of sheet metal tools and development of Pen stand and funnel (2-Models)	Sheet metal tools and soldering tools	Creative Thinking
5.	Hands on training on basic welding joint (Butt Joint-1 Model)	Welding tools	Hands on experience
6.	To study the carpentry tools with one model (Half joint-Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling	Comprehend the different handling carpentry tools
7.	To study the carpentry tools with one model (Dovetail-Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling	Comprehend the different handling carpentry tools
8.	To study the carpentry tools with one model (T-Joint - Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling	Comprehend the different handling carpentry tools
9.	To Study the plumbing tools and to make threads on pipe and pipe fittings using plumbing tools	Plumbing Tools	Comprehend the different handling plumbing tools
10.	To Study the plumbing tools used for valves and sanitary fitting	Plumbing Tools	Comprehend the different handling plumbing tools

TEXT BOOKS:

1. K.R. Gopalkrishna ,“Elements of Mechanical Engineering”, 12th Edition, Subhash Publishers, Bengaluru, 2012.
2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, Mumbai, 2000.
3. Mikell P Groover : Automation, Production Systems, and Computer Integrated Manufacturing , Pearson India, 2007, 4th Edition

REFERENCE BOOKS:

1.SKH Chowdhary, AKH Chowdhary, Nirjhar Roy,”The Elements of Workshop Technology Vol I & II, 11th edition, Media Promotors and publisher, Mumbai, 2001.
2.Avikshit Saras, “3D Printing-Made Simple”, BPB Publications-New Delhi.

JOURNALS/MAGAZINES

International Journal of Machine Tools and Manufacture
2.International Journal of Refrigeration.

SWAYAM/NPTEL/MOOCs:

1.https://nptel.ac.in/courses/112/103/112103262/#
2.https://www.my-mooc.com/en/mooc/fundamentals-manufacturing-processes-mitx-2008x/
3.https://www.coursera.org/learn/3d-printing-applications

Course Title	Programming for Problem Solving				Course Type		Integrated	
Course Code	B20CS0102	Credits	4		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50%**	**50%**

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.
6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-6	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5	1
CO3	Develop text processing based applications using string operations.	1-5	2,3
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2,3
CO5	Learn new algorithms and technologies in C Programming and apply for suitable application development	1-5	2,3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	1							3		
CO2	1	3	2	2	1								3		
CO3	2	2	2	2	1									3	3
CO4	3	3	3	1	1									3	3
CO5	3	3	3	2	2	1									
CO6	3	3	3	2	2	2							3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Algorithm: Definition, Purpose of writing an algorithm, Rules for writing an algorithm, Advantage of writing algorithm and examples. Flowchart: Definition, Notations used to write a flow chart, Advantage and disadvantages of writing the flowchart and examples. Introduction to "C": Introduction to GitHub, Structure of C program with example, C language & its features, C tokens, data types in C, variables, constants, input and output functions
UNIT-2
Operators and Expressions: Unary operator, assignment operator, arithmetic operator, relational operators, logical operators &bitwise operator, conditional operator, increment and decrement operator, special operator. Conditional Statements: if statement, if-else statement, nested if, switch statement. Unconditional Statements: break and continue statement, goto statement, return statement Iterative Statements (loops): while loop, do-while, for loop, differences between while, do-while and for loop.
UNIT-3
Arrays: one dimensional array, two dimensional array, Linear and binary search and bubble sorting. Functions: Structure of a function, types of functions, parameter passing mechanisms, Command line arguments. Strings: string operations with and without using inbuilt string functions.
UNIT-4
Structures & Union: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, union, typedef. Pointers: Introduction to pointers. File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions, File Positioning Functions, Error Functions

PRACTICE:

PART A:			
No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**
1	Consider Loan applications in a bank consisting of various customer details such as Name, Organization, salary and loan amount applied. Segregate the loan applications based on income (low: <=5 lpa, medium: >5lpa <10lpa and high:>10lpa)	Condition checking	Apply if-else and switch
	Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are placed in the third file. Display the contents of DATA.	Files operations	Apply File concepts
2	Statistical measures are used for data analysis and interpretation. Develop program to determine the mean and stand deviation of data stored in an array.	Statistical Computing	Use Array and loops
	Consider the details of Airline passengers such as Name, PAN-No., Mobile-no, Email-id, Source, Destination, Seat-No and Air-Fare. Develop a program to read the details of airline passengers, store them in the structure "Airline" and List details of all the passengers who travelled From "Bengaluru to London".	Search technique	Apply Structures

3	Assume that Mr. Peterson shopped N items at Big Market and his Cart comprises of name of the item, cost of the item per UNIT and quantity. Read the details of shopping and store them in the structure “Shop”. Compute the total amount spent on shopping at Big Market and also find out the item with minimum and maximum cost.	Statistical measure	Apply Structure and if then else
	b. Write a C program to define a structure named Student with name and DOB, where DOB in turn is a structure with day, month and year. Read the details of student and store them in the structure “Student”. Display name and date of birth of students using the concept of nested structures.	Nested Structures	Apply Nested Structures
4	Consider a set of N students with SRN, name, and marks scored in 8 subjects. Read the details of students and store them in the structure “Student_Marks”. Compute total marks and average marks of each student and display them with suitable headings.	Average computation and visualization	Apply Structure, Array and Loops
	b. Create the structure “Book” with book_id, title, author_name and price. Write a C program to pass a structure as a function argument and print the book details.	Functions	Passing structures to function
5	Assume that Ms. Jassica shopped N items at Amazon and the Cart comprises of name of the item, cost of the item per UNIT and quantity. Arrange the items in the increasing order of cost of the item per UNIT.	Sorting	Apply sorting the contents of structure.
	Write a C program to compute the monthly pay of “N” employees using each employee’s name, Basic_Pay, DA and HRA. The DA and HRA are 80% and 30% of the Basic_Pay respectively. Gross-salary is computed by adding DA and HRA to Basic_Pay. Store all the details in an array of structures and print the name and gross salary of each employee.	Reading and storing data	Use structures for reading and storing data
6	a. Consider the details of “N” Faculty members consisting of Name, EMP-ID,name of the school, address and salary. Create a file to store the above details. Retrieve the contents of the file to perform following operations: (i) Display the details of the faculty based on salary range entered. (ii) Display the details of the faculty based on the EMP-ID entered.	File operations	Create file, store data and display details.
	b. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if else and switch case.	String operations	Apply string functions

PART B:			
	Project 1: Address Contact List with the following modules: User Add User(Name, Address, Primary contact number, secondary contact number, E-mail ID) Delete User Search for User Edit Find and replace the user name Edit the contact (Phone Number) details. Edit the Address of the user Report List of users based on the starting letter of their names. List of users based on first 2 digits of their mobile number. List of users based on the domain name of their E-mail ID.		
1	Develop a program in C to create the structure "Contact" with the fields, user_name, address, mobile, phone1 and email_id. Read the data into the structure "Contact" and store them in the file "Contact.txt".	Structures and Files	Develop the program using Structures and Files
2	Develop a program in C to open contact list from the file "Contact.txt" in read mode and delete contact details of the person based on name of the person by searching his/her details. Display the updated list.	String, File and Linear Search	Develop the program using String and File
3	Develop a program in C to input the string,"Str1"(which can be either a mobile no. or name of the user) and search for it in the file , "Contact.txt" and display the details if it is found else display an error.	String, File and Linear Search	Develop the program using String and File
4	Develop a program in C to input the name of the user into the string, "Str1" , search for it in the file "Contact.txt" and replace the content of "Str1" with the new data if found.	String, File and Linear Search	Develop the program using String, File and apply linear search
5	Develop a program in C to input the phone number of user into the string, "Str1", search for it in the file "Contact.txt" and edit it with new data if found and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
6	Develop a program in C to input the address of the user and search for the same in the file, "Contact.txt" and edit the address with new address and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
7	Develop a program in C to input a letter into "Letter", compare it with the details stored in "Contact.txt" and then display the list of the users whose name begin with "Letter ".	File operations	Develop the program using file
8	Develop a program in C to input first two digits of a mobile number into "Mobile", search for the same in "Contact.txt" and display the details of all the users whose mobile number begin with "Mobile".	File operations	Develop the program using file
9	Develop a program in C to input a domain name of email-id and search for the same in the file, "contact.txt" and list the details of the users whose email-id matches with the given domain name.	File operations	Develop the program using file

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL SOFTWARE SERIES, 2005.
2. Herbert Schildt, "C: The Complete Reference", 4th edition, TATA McGraw Hill, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A Holistic Approach", second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker, "Computer Graphics C Version", second edition, Pearson Education, 2004.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294
   (IEEE Journal/Magazine on IT Professional)
2. https://ieeexplore.ieee.org/document/1267572
   (IEEE Computing in Science and Engineering)

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs06/preview
   (Problem Solving through Programming in C)
2. https://www.edx.org/course/c-programming-getting-started
   (C Programming Getting started)
3. https://www.coursera.org/specializations/c-programming
   (Introduction to C programming)

SELF-LEARNING EXERCISES

1. **Fundamentals of computer graphics**: output primitives–Line, Circle and Ellipse drawing algorithms- Attributes of output primitives.
2. **Inline Assembly Language Program:** Simple inline assembly, Extended Assembly Syntax Microsoft C Compiler.

Course Title	IoT and Applications				Course Type		Integrated	
Course Code	B20EC0101	Credits	2		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**3**	**3**	**13**	**26**	**30%**	**30%**

COURSE OVERVIEW

The Internet of Things (*IoT)* expands access to the world-wide web from computers, smartphones, and other typical devices to create a vast network of appliances, toys, apparel, and other goods that are capable of connecting to the Internet. This introductory course focuses on IoT architecture, its domains and communication protocols. The course is supported with hands on sessions that incorporates different types sensors interfaced with IoT board to build IoT projects to solve real time problems. The case study of deployment of IoT in various applications are provided.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain the architecture of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interface of various sensors to IoT Boards.
4. Discuss the various applications of IoT.
5. Learn new technologies in the IoT and apply for suitable application development.
6. Develop simple IoT projects and modules.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the architecture of IoT eco-system	1	1,2
CO2	Identify IoT devices, architecture, sensors and Communication protocols	1	1,2
CO3	Demonstrate the interface of sensors to IoT board	1,5, 12	1,2
CO4	Realize various Applications of IoT through case studies	1,5, 12	1,2
CO5	Learn new technologies in the IoT and apply for suitable application development.	1,5,9, 12	1,2
CO6	Develop simple IoT projects and modules	1,5,6,9, 12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√				
CO3			√			
CO4				√	√	
CO5			√			√
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	
CO2	3												3	3	
CO3	3				3							3	2	2	
CO4	3				3							3	1	1	
CO5	3		2		3				2				1	1	1
CO6	3				3				2			3	3	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT-I
IoT Basics: Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages and Disadvantages of IoT, Embedded Devices in IoT, IoT eco-system **IoT Architecture and IoT Devices**: Components of IoT architecture, Stages of IoT solution architecture, Smart Objects, IoT Devices.
UNIT-II
IoT boards in Market: Arduino, Arduino UNO, ESP8266, Raspberry Pi **IoT Platform:** Amazon Web Services (AWS) IoT platform, Microsoft Azure IoT platform, Google Cloud Platform IoT, IBM Watson IoT platform, ThingWork IoT platform Technologies Used in IoT: Bluetooth, Wi-Fi, Li-Fi, RFID, Cellular, Z-Wave

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Introduction to IoT Board Arduino UNO Arduino Nano Node MCU Ethernet Shield	Hardware	Identifications of various parts of Arduino and Node MCU boards Study of Ethernet shield and
2.	Working with Arduino IDE (Integrated Development Environment)	Open source Arduino IDE	Download specified software Modify code as per the
3.	a) Demonstration of Multimeter usage b) Demonstration of Breadboard connection for Voltage, Ground, series and parallel connections c) Exercise to read the value of resistor using Color code chart	Multimeter Breadboard Resistor packs	Measurement of voltage at various points in IoT boards Choose the value of Resistor for an application
4	Reading photo resistor sensor value connected to Arduino Board	Arduino UNO Arduino IDE LDR, Multimeter, Resistor	Interface of photo sensor to IoT board for light measurement applications
5	Reading temperature sensor value connected to Arduino Board	Arduino UNO, Arduino IDE, Temperature sensor, Multimeter	Interface of Temperature sensor to IoT board for temperature measurement application

6.	Reading motion detector sensor value connected to IoT board	Arduino UNO, Arduino IDE, pyro-dielectric sensor, Multimeter	Interface of Motion detector sensor to IoT board for motion detection applications
7	Reading distance measurement using Ultrasonic sensor Connected to IoT board	Arduino UNO, Arduino IDE, Ultrasonic sensor, Multimeter	Interface of Motion detector sensor to IoT board for motion detection
8	Interface relay to IoT board	Arduino UNO, Arduino IDE, relay Multimeter	Interface relay to IoT board for switching applications
9	Connect Wifi-ESP8266 to Arduino UNO board , Send and receive data through smart phone.	Arduino UNO ESP8266, Arduino IDE Smart phone	Connect IoT board to Wifi network
9	Mini Projects Arduino Controlled Light intensity Thermometer Motion activated light lamp Touchless motion sensor trash can		

TEXT BOOK:

1. Vijay Madisetti, Arshdeep Bahga," Internet of Things: A Hands-On- Approach", ISBN: 978 0996025515, 2014.

REFERENCE BOOKS:

1. Raj Kamal," Internet of Things: Architecture & design Principle", McGraw Hill Education, 2017.

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/learn/iot
2. https://www.coursera.org/learn/interface-with-arduino

SELF-LEARNING EXERCISES:

a) Create Arduino project hub

Course Title	ENTREPRENEURSHIP				Course Type		Theory	
Course Code	B20ME0104	Credits	1		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**1**	**1**	**1**	**13**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This is an *introductory course* is designed to provide the foundational concepts of *entrepreneurship*, including the definition of *entrepreneurship*, the profile of the *entrepreneur*, and the role of venture creation in society. The course also provides a bird's eye view on the steps to start a venture, financing, marketing as well as support by various institutions towards entrepreneurship.

COURSE OBJECTIVE

1. To understand the basic terms, concepts in Entrepreneurship Development
2. To apply for the supporting schemes towards entrepreneurship

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the key terms, definitions, and concepts used in Entrepreneurship Development	1	1
CO2	Plan a startup and understand sources available for finance and the supporting schemes offered by state and central governments and other entrepreneurial development organizations	1,2	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2	2											2	1	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT-1
INTRODUCTION TO ENTREPRENEURSHIP Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Psychological factors, Social factors, Economic factors, Environmental factors. Characteristics of an entrepreneur, Difference between Entrepreneur and Entrepreneurship, Types of entrepreneurs. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving
UNIT-2
INSTITUTIONAL SUPPORT FOR ENTREPRENEURSHIP Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs

TEXT BOOKS:

1. K. Ramachandran," Entrepreneurship Development", Tata Mc. Graw Hill, 2008.
2. Sangeeta Sharma, "Entrepreneurship Development", PHI Publications, 2016.

REFERENCE BOOKS:

1. Baringer and Ireland, "Entrepreneurship", 11th Edition, Pearson, 2020.
2. P. Narayana Reddy, "Entrepreneurship – Text and Cases", Cengage Learning India, I edition, 2010
3. Paul Burns,"Corporate Entrepreneurship: Building The Entrepreneurial Organization", Palgrave Macmillan.
4. Drucker F Peter,:"Innovation and Entrepreneurship", 1985.Heinemann, London.

5. Doanld F Kuratko & Richard M ,"Entrepreneurship in the New Millennium", India Edition.

JOURNALS/MAGAZINES

1. International Small Business Journal: https://journals.sagepub.com/home/isb
2. Journal of Development Entrepreneurship: https://www.worldscientific.com/worldscinet/jde

SWAYAM/NPTEL/MOOCs:

1. Entrepreneurship: https://nptel.ac.in/courses/110/106/110106141/

SELF-LEARNING EXERCISES:

1. Introverts participate. If you have a few vocal students asking questions and little participation from others, anonymous questions lower student anxiety, which makes it easier for everyone to participate.
2. You learn what students are thinking about. Anonymity provides cover for students to ask questions they may be too afraid to ask but are curious about.
3. Discussions start. Anonymity means you can invite students to pose "challenging" questions. If you encourage your students to question what they're learning, why it's important, or why they should have to do the work you're assigning, you spark discussions about how entrepreneurship is relevant, which can often be the key to increasing engagement.

PROBLEM BASED LEARNING

No.	
1	How to write a Business Plan
2	Creating Marketing, Financial and Organizational Plans.
3	How to apply for financial assistance via various schemes
4	How to file taxes as a Small Business and understand the importance of GST

Detailed Syllabus
Semester -3

<table>
<tr><td>Course Title</td><td colspan="4">Analog and Digital Electronics</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20CI0301</td><td>Credits</td><td colspan="2">4</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>4</td><td>5</td><td>5</td><td>39</td><td>26</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW

This course covers basic concepts of Electrical Engineering. The course introduces the working of analog components and helps in understanding basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes and opamps.The course provides foundation on designing and implementation of logic circuits. Analog circuits are simulated using ORCAD tool and digital circuits using XILINX tool which helps in gaining experience in creating and testing of circuits.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.
2. Describe the foundation on designing, building and testing of common combinational and sequential Digital logic circuits.
3. Explain the procedure required for simulation of digital logic circuits.
4. Analyze the working principle and designing of analog circuits using ORCAD tool
5. Analyze the working principle and designing of digial circuits using XILINIX tool
6. Demonstrate the use of general electronic instruments in design and testing of digital logic circuits.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in rectifiers, filter circuits and wave shaping	1 to 4	1
CO2	Apply the basic knowledge used in solid state electronics including diodes, and operational amplifiers for specific engineering applications.	1 to 3, 5	1
CO3	Identify the different families of digital integrated circuits build, and troubleshoot combinatorial circuits using digital integrated circuits	1 to 5	2
CO4	Analyze the working principle and designing of analog circuits using ORCAD tool	1 to 4	1
CO5	Analyze the working principle and designing of digial circuits using XILINIX tool	1 to 4	1
CO6	Develop the ability to analyze and design analog electronic circuits using discrete components	1,4,5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		
CO2			√			
CO3			√			
CO4				√		
CO5				√		
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2									3		
CO2	3	2	3		2								3		
CO3	3	1	2	1	2									3	
CO4	3	1	1	2									3		
CO5	3	1	1	2									3		
CO6	3			2	2										3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Limiters and Oscillators: Clipping and clamping circuits using diodes, Oscillator operation, Phase shift Oscillator, Wien bridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only) Simple design methods of Oscillators.

UNIT- 2

Operational Amplifiers: Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters-First order LPF and HPF, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier-Log and antilog amplifier.

UNIT – 3

Principle and Minimization Techniques of combinational Circuits: Introduction to combinational logic, Minimization Techniques: Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), 3 and 4 Variable Karnaugh map.

UNIT – 4

Analysis of Combinational and sequential Circuits: Half adder, full Adder, Half Subtractor,full Subtractor,multiplexers and Demultiplexers.

Introduction to Sequential circuits: flip-flops: SR, JK, D, T Characteristic tables and equations; Application of Shift register (Ring Counter and Johnson counter).

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1	To simulate a positive clipper, double ended clipper & positive clamper circuits using diodes	Orcad	Simulation of clipper and clamper electronic
2	To simulate a rectangular wave form generator (Op-amp relaxation oscillator) and compare the frequency and duty cycle with the design specifications	Orcad	Simulation of rectangular waveform generator
3.	To simulate a Schmitt trigger using Op-amp and compare the UTP andLTP values with the given specification	Orcad	Simulation of Schmitt trigger
4.	To simulate a Wien bridge Oscillator	Orcad	Simulation of wein bridge oscillator
5.	To determine the working of a power supply and observe the waveforms	Orcad	Simulationof power supply
6.	To build and simulate CE amplifier (RC coupled amplifier) for itsfrequency response and measure the bandwidth.	Orcad	Simulation of RC coupled amplifier and determining the frequency response

7.	Realization of Half/Full adder and Half/Full Subtractors using logic gates	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits
8.	Design and develop VHDL code to realize Full adder and Full Subtractors	Xilinx	Simulation knowledge of the mentioned adders an
9.	.Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC	ICs, Trainer kit and patch cords	Realization of a multiplexer
10.	Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working	Xilinx	Simulation knowledge of combinational logic circuit
11.	Design and implement a ring counter using 4-bit shift register and demonstrate its working	ICs, Trainer kit and patch cords	Realization of shift register and ring counter
12.	Design and develop the Verilog / VHDL code for switched tail counter.	Xilinx	Simulation of ring counter

TEXT BOOKS:

1. Anil K Maini, Varsha Agarwal," Electronic Devices and Circuits", Wiley, 2009.
2. Jacob Millman, Christos Halkias, Chetan D Parikh," Millman's Integrated Electronics – Analog and Digital Circuits and Systems", 2nd Edition, Tata McGraw Hill, 2010.
3. Donald P Leach, Albert Paul Malvino&GoutamSaha," Digital Principles and Applications", 7th Edition, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Stephen Brown, ZvonkoVranesic," Fundamentals of Digital Logic Design with VHDL", 2nd Edition, Tata McGrawHill, 2005.
2. R D Sudhaker Samuel, "Illustrative Approach to Logic Design", Sanguine-Pearson, 2010.
3. Charles H. Roth," Fundamentals of Logic Design", Jr., 5th Edition, Cengage Learning, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss," Digital Systems Principles and Applications", 10th Edition, Pearson Education, 2007.
5. M Morris Mano," Digital Logic and Computer Design", 10th Edition, Pearson Education, 2008.
6. Jacob Millman, Christos Halkias, "Analog and Digital Circuits and Systems", 2nd Edition, Tata McGraw Hill, 2010
7. R. D. Sudhaker Samuel," Electronic Circuits", Sanguine-Pearson, 2010

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1. https://ieeexplore.ieee.org/document/1085417
2. https://www.academia.edu/Documents/in/Digital_Electronics
3. https://www.mdpi.com/journal/electronics/special_issues/circuit_machine_learning

SWAYAM/NPTEL/MOOCs:

1. https://technobyte.org/digital-electronics-logic-design-course-engineering/
2. https://www.udemy.com/course/digital-electronics-logic-design/
3. https://www.javatpoint.com/digital-electronics/.

Course Title	Programming with JAVA				Course Type		Integrated	
Course Code	B20CI0302	Credits	4		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW

Java's unique architecture enables programmers to develop a single application that can run across multiple platforms seamlessly and reliably. In this course, students gain extensive experience with Java, object-oriented features and advance Java programming skills. Students learn to create robust object-oriented applications with Java.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.
5. Discuss object-oriented features and advance Java programming skills
6. Explain to create robust object-oriented applications with Java.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2
CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√			
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1								3		
CO2	3	3	2	2	1								3		
CO3	3	3	1	1	1									3	3
CO4	3	3	3	1	2							1		3	
CO5	3	3	3	1	2								3		
CO6	3	3	2	2	2									3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Fundamental Programming Structures: Dissecting the "Hello, World" Program; Compiling and Running a Java Program; Primitive Types; Variables; Arithmetic Operations; Strings; Input and Output; Control Flow; Arrays; Functional Decomposition.

UNIT – 2

Object-Oriented Programming: Working with Objects; Implementing Classes; Object Construction; Static Variables and Methods, Packages; Nested Classes; Documentation Comments; Interfaces; Static, Default and Private Methods in interface; Lambda Expressions; Method and Constructor References; Local and Anonymous Classes.

UNIT – 3

Inheritance and Exceptions: Extending a Class; Object: The Cosmic Superclass; Enumerations; Runtime Type Information and Resources; Exception Handling: Throwing Exceptions; The Exception Hierarchy; Declaring Checked Exceptions; Catching

Exceptions; the Try-with-Resources Statement; The finally Clause; Rethrowing and Chaining Exceptions; Uncaught Exceptions and the Stack Trace.

UNIT – 4

Generic Programming and Collections: Generic Classes; Generic Methods; Type Bounds; Type Variance and Wildcards; Restrictions on Generics; an Overview of the Collections Framework; Iterators; Sets; Maps.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	The sieve of Eratosthenes is one of the most efficient ways to find all primes smaller than n when n is smaller than 10 million. Given a number n, use JAVA to print all primes	Windows/Linux OS, IDE	Understanding conditional operators and statements
2.	The Gauss-Jordan method is also known as Gauss-Jordan elimination method is very useful in solving a linear system of equations. It is a technique in which a system of linear equations is resolved by the means of matrices. Develop a	Windows/Linux OS, IDE	Creating an array and performing some operations on array.
3.	To compute a square root of any positive number a, start with an initial guess x=x1 for √a; then calculate successive approximations x2,x3...,√a using the formula: $x_i = \frac{x_{i-1} + (a/x_{i-1})}{2}, i = 2, 3, \ldots$	Windows/Linux OS, IDE	Understanding conditional statements (if, if..else, etc)
4.	Model a lamp as a Java object. Make a Lamp class. This will contain atleast one instance variable which will be of type Boolean and will hold the state of the lamp: i.e., whether it is on or off. In addition, add methods to do the following things: switch the light on and off, and check its current state, i.e., whether it is on or off. Maintain proper encapsulation mechanism. Next, write a launcher class with a main() method to carry out the following tasks:	Windows/Linux OS, IDE	Object and class creation and its usage

5.	Given the following functional interface:
	interface MathOperation {
	int operation(int a, int b);
	}
	Develop an application that would implement the above interface using lambda expressions as to perform the
		Windows/Linux OS, IDE	Creation of interfaces and its usage.

6.	The String class in JAVA has a static method compare To Ignore Case, which compares two strings and the Arrays class has a static sort method. Build a JAVA program that creates an array of strings, use the sort function from Arrays class to sort the strings by passing the compare To Ignore	Windows/Linux OS, IDE	Creation of string class and its usage
7	XYZ technologies is firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize its payroll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. Income Tax is 40% of gross salary for all employees. The annual increments to the employees are to be given of the following criteria: -Manager 10% of the basic salary, and Technicians 15% of basic. Develop the pay roll for XYZ. Implement a class hierarchy using	Windows/Linux OS, IDE	Creation multiple inheritance and its usage
8	Define a new Exception class named Odd Exception. Create a new class named Even Odd. Write a method called halfOf(), which takes an int as parameter and throws an Odd Exception if the int is odd or zero, otherwise returns (int / 2). Write a main method that calls halfOf() three times (once each with an even int, an odd int, and zero), with three	Windows/Linux OS, IDE	Creation of exception class and its usage
9	Implement a class named Fraction that represents fractions with numerator and denominator always stored reduced to lowest terms. If fraction is negative, the numerator will always be negative, and all operations leave results stored in lowest terms. Implement the addition, subtraction, multiplication and division operation for the Fraction class	Windows/Linux OS, IDE	Creation of exception class and its usage
10	Create a class Student that has instance variables as Name, Age, Address and access transmutation methods to access the instance variables along with display method to print the details of student. Next write a main() function that will create a collection of 10 students and reverse the list. Print	Windows/Linux OS, IDE	Object and class creation and its usage

11	Use generics to build a class Sort. Implement the bubble sort algorithm to sort an array of any type.	Windows/Linux OS, IDE	Creation of generics class and its usage
12	Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).	Windows/Linux OS, IDE	Creation of generics class and its usage

Sl. No.	**Part B Mini Project**
1	Develop a project for Airline reservation system List with the following modules: 1. PASSENGER a) Add member b) Delete member c) Search for member d) Edit member 2. FLIGHT a. Add Flight b. Delete Flight c. Search Flight d. Display Flights 3. RESERVATION a. Book b. Cancel Title: Airline Reservation system Problem Definition: *Airline Reservation System*" main aim is to provide the online ticket & seat reservation of National and International Flights and give the information about flight departures. Solution: Develop a project to implement an Airline reservation system with the following modules: 1. PASSENGER a. Add member b. Delete member c. Search for member d. Edit member 2. FLIGHT a. Add Flight b. Delete Flight c. Search Flight d. Display Flights 3. RESERVATION a. Book b. Cancel
List of Experiments:	
Sl.No	Name of the Experiment
1	Create a passenger class with the attributes Adhar_number, Passenger_name, Email_id, Phone, Address, DOB and the methods to facilitate Addition, Deletion, Search and Modify the passenger data. Store the details of the 10 passenger objects in "Passenger.txt" and Display. a. void Add_passenger() b. Display_details() c. void Delete_Passenger(Adhar_number)

	d. void Search_Passenger(Adhar_number) e. void Modify_Passenger(Adhar_number)
2	It is required to delete an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be deleted and delete the record from "passenger.txt" if found. Otherwise display an error message saying that "record does not exist". Develop a program to implement the above task.
3	It is required to modify an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be modified and modify the record from "passenger .txt" if found. Otherwise display an error message saying that "Record does not exist". Develop a program to implement the above task.
4	It is required to Search an existing passenger data based on the request from the passenger. Read Adhaar card number of the passenger to be searched for, search the record from "passenger .txt" and display the details of passenger if found. Otherwise display the error message "Record does not exist". Develop a program to implement the above task.
5	Create a Flight class with attributes Flight_number, Flight_name, Source, Destination, Departure_Timing and the methods Add_Flight(), Delete_Flight(), Search_Flight() and Display_Flight(). Store the details of any 5 Flights in a file called "Flights.txt" and display the same. Develop a program to achieve the above task.
6	It is required to delete the details a flight stored in "Flights.txt". Read the Flight_no and search for the same in "Flights.txt". If found, it should be deleted from "Flights.txt". Otherwise display the error message "Flight Does Not Exist". Develop a program to achieve the above task.
7	It is required to delete the search for a flight stored in "Flights.txt". Read the Flight_no and search for the same in "Flights.txt". If found, Display the details of Fllight, otherwise display the error message "Flight Does Not Exist". Develop a program to achieve the above task.
8	It is required to display the details of all the flights running from Source1 to Destination1. Read the name of source1 and destination1 and fetch from "Flights.txt" the details of all the flights running between Source1 and desitnation1 and display the same. Develop a program to achieve the above task.
9	Create a reservation class that facilitates booking and cancellation of domestic and international flights using the following methods and parameters. Develop a program to store the details of 10 bookings in "**Reservations.txt"** and display the same. a. Book_Ticket(Flight_Number, Flight_Name, Ticket_Number,Source, Destination, Adhar_number, Passport_number,Date, Departure_time, Class, Type_of_Travel(Domestic , International), Fare, Status) b. Cancel_Ticket(Ticket_Number)
10	A passenger would like to cancel the ticket due to a genuine reason. Read the ticket_no and search for the record in "Reservation.txt". Cancel the Ticket based on the request from passenger and update the status.

TEXT BOOKS:

1. Cay S. Horstmann," Core Java® SE 9 for the Impatient", Addison Wesley, Second Edition, 2018.
2. HerbertSchild," Java™: The Complete Reference", McGraw-Hill, Tenth Edition,2018.
3. David Gallardo, Ed Burnette, Robert Mcgovern," Eclipse in Action a guide for java developers", Manning Publications,2003.
4. Ed Burnette;" Eclipse IDE Pocket Guide: Using the Full-Featured IDE", O'Reilly Media, Inc, USA,2005.

REFERENCE BOOKS:

1. Cay S. Horstmann," Core Java™ Volume I—Fundamentals", Prentice Hall, Tenth Edition, 2015
2. Joshua Bloch," Effective Java", Addison-WesleyProfessional, ThirdEdition,2017
3. Ken Kousen, " Modern Java Recipes", O'Reilly Media, Inc.,2017
4. Oracle Java Documentation. (https://docs.oracle.com/javase/tutorial/)

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1. https://ieeexplore.ieee.org/document/5464387
2. https://files.eric.ed.gov/fulltext/EJ1075126.pdf
3. https://www.sciencedirect.com/science/article/pii/S0167642304000590
4. https://www.informingscience.org/Publications/4322?Source=%2FJournals%2FJITEIIP%2FArticles%3FVolume%3D0-0
5. https://www.javadevjournal.com/
6. https://blogs.oracle.com/javamagazine/

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs84/preview
2. https://www.classcentral.com/course/swayam-programming-in-java-12930
3. https://swayam.gov.in/explorer?searchText=java

Self-Learning Exercises:

1. The Eclipse-IDE
2. Streams
3. Concurrent Programming
4. Swing and JavaFX
5. Networking- JDBC, Database Access

Course Title	Data Structures				Course Type		Integrated	
Course Code	B20CI0303	Credits	4		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW

The course focuses on basic and essential topics in data structures, including array-based lists, linked lists, recursion, stack, queues, and binary trees, heaps, sorting and searching algorithms. It also covers analysis and design of fundamental data structures and engages learners to use data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the concept of Abstract Data Types (ADT)
2. Provide the knowledge of stacks and queues.
3. Understand the importance of Linked lists
4. Illustrate the operations of trees
5. Demonstrate the use of appropriate of data structures for a given problem.
6. Design a data structure application for real time problems.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the Abstract Data Types, Structures	1 to 5	1
CO2	Formulate the solution for any computational problem using stacks and queues.	1 to 5	1,2
CO3	Analyze the importance of linked lists.	1 to 5	1,2
CO4	Solve real time problems using trees data structure.	1 to 5	1,2
CO5	Apply appropriate data structures to solve a given problem.	1 to 5	1
CO6	Compare the performance of various data structures.	1 to 5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5		√				
CO6			√			√

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		2					1	2		3		
CO2			1					1					3	3	
CO3					2		2		2				3	3	
CO4	3	3					2	1	2	1			3	3	
CO5	1				1		2	2	2			2	3		
CO6		1					2	2	2			2	3	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Data structures and Algorithms: Data, Data Types, Abstract Data Types and Examples, Algorithms, Arrays: One Dimensional and Two Dimensional, Structures: Introduction to structures and nested structures.

UNIT – 2

Data Structures-1: Stacks, Evaluation of expressions: Infix, Prefix, postfix; Queues: Simple, circular and priority Queues.

UNIT – 3

Data Structures-2: Pointers; Dynamic memory allocation; Linked List: singly linked list, doubly linked list, stack using linked list, queue using linked list.

UNIT – 4

Data Structures-3: Trees: Binary Tree, Binary Tree Traversals, Binary search Tree.

Self-learning component: AVL Trees, Threaded Binary Trees, Heaps, Sparse Matrix, Searching and sorting techniques.

PRACTICE:

1	Design, Develop and Implement a menu driven Program in C for the following Array operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. Support the program with functions for each of the above operations.
2	Design, Develop and Implement a Program in C for the following operations on Strings a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: c. Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. d. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Note: Don't use Built-in functions
3	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^ (Power) and alphanumeric operands.
5	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks 21 6 Design, Develop and Imp
6	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion and Deletion at End of SLL d. Perform Insertion and Deletion at Front of SLL e. Demonstrate how this SLL can be used as STACK and QUEUE f. Exit
8	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue f. Exit

9	Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Delete an element(ELEM) from BST e. Exit

TEXT BOOKS:

1. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
2. Joshi, Data Structures and Algorithms In C, Tata McGraw-Hill Education, 2010.

REFERENCE BOOKS:

1. The design and analysis of computer algorithms, 4th Edition Addison-Wesley
2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, Addison-Wesley, 1987.
3. Richard Gilberg, Behrouz Forouzan, Data Structures: A Pseudo code Approach with C, Cengage Learning, 2004.
4. ACM Transactions on Data structures
5. ACM Journal of Algorithms and Computational Technology.

JOURNALS/MAGAZINES

1. https://www.imedpub.com/scholarly/data-structure-journals-articles-ppts-list.php
2. https://www.mdpi.com/journal/algorithms/special_issues/Efficient_Data_Structures
3. https://ieeexplore.ieee.org/document/4055607
4. https://ieeexplore.ieee.org/abstract/document/6312216
5. https://www.sciencedirect.com/science/article/pii/0022000083900065
6. https://www.sciencedirect.com/journal/journal-of-algorithms

SWAYAM/NPTEL/MOOCs:

1. Coursera – Data Structures and Algorithms Specialization
2. Coursera – Data Structures, University of California San Diego
3. Data Structures and Algorithms, National Research University Higher School of Economics
4. https://nptel.ac.in/courses/106/102/106102064/
5. https://nptel.ac.in/courses/106/106/106106127/
6. https://nptel.ac.in/courses/106/103/106103069/

Self-Learning Exercises:

1. Storing game entities in a array
2. Pseudo-random number generators
3. Reversing an array using a stack
4. Matching parentheses and HTML tags
5. Double ended queue
6. Application of tree traversals

Course Title	Discrete Mathematics and Graph Theory				Course Type		Theory	
Course Code	B20AS0302	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50**	**50**

COURSE OVERVIEW

Discrete Mathematics is the study of discrete objects. Discrete Mathematics is used to develop our ability to understand and create mathematical arguments and also used to provide the mathematical foundation for advanced mathematics and computer science courses.Graphs (abstract networks) are among the simplest mathematical structures, which are used in most of the areas of Computer Science to solve the complex problems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain mathematical arguments using logical connectives and quantifiers.
2. Illustrate the operation on discrete structures such as sets, relations and functions.
3. Describe the theory and application of graphs, fundamental theorems and their proofs.
4. Demonstrate the use of graphs to model many types of relations and processes in physical, biological. Social and information system.
5. Explain to provide the mathematical foundation for advanced mathematics
6. Illustrate to use discrete mathematics to solve the complex problems in most of the areas of Computer Science

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives and quantifiers	1 to 4	2
CO2	Apply the operations like union and intersection on discrete structures such as sets, relations and functions	1 to 3, 5,6	2
CO3	Make use of graph and fundamental theorems in real world applications	1 to 6	2
CO4	Develop a model using advanced concepts of graph for real world applications	1,2,4,5,6	2
CO5	Apply the mathematical foundation for advanced mathematics	1 to 3, 5,6	2
CO6	Solve the complex problems in most of the areas of Computer Science	1,2,3,4	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
C06					√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2										3	
CO2	3	2	3		2	1								3	
CO3	3	1	2	1	2	3								3	
CO4	3	2		2	2	2								3	
CO5	3	2	3		2	1								3	
C06	3	2	3	3											3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Set Theory and Logic: Fundamentals of Sets, Sub sets, Venn diagram, Operations on sets, Laws of set theory, Countable and Uncountable sets, Addition Principle, Extended Addition Principle, Propositions, Logical Connectives and truth tables (Illustrative Examples), Logical equivalence, Laws of logic, Duality, NAND and NOR connectives (Circuits), Converse, Inverse and Contrapositive, Rules of Inference, Open statements, Quantifier, Logical implication involving quantifiers, Statement with more than one variable. Methods of Proofs and Disproof.

UNIT – 2

Relations and Functions : Cartesian product of sets (Illustrative Examples), Matrices and Digraph of the relations, Properties of relations, Equivalence relations, Partial ordered relations, Posets, Hasse diagrams, Extremal elements in posets, Types of Functions, properties of Functions, The pigeon hole principle, composite functions, invertible functions, Floor and ceiling functions, Sterling number of second kind.

UNIT – 3

Introduction to graph theory: Konigsberg's bridge problems, Utilities problem, Seating Problem, Graphs, Representation of Graphs. Directed graphs, Incidence, Adjacency, Degree, In degree, Out degree, Regular graphs, Complete graphs, Null Graph, Bipartite Graphs, Isomorphism, Directed Graphs, Sub graphs, Walk, Trail, Path, Circuit, Cycle, Connected and disconnected graphs, Components, Weakley connected and Strongly connected Components, Complement of graphs, Partition and Decompositions.

UNIT – 4

Euler and Hamiltonian graphs and Graph coloring: Operation on graphs, Definition of Euler Trail, Euler Graphs, Hamiltonian path, Hamiltonian Cycle, Hamiltonian Graphs, Standard Theorems on Euler and Hamiltonian graphs, planar graph, detection of Planarity, Dual of planar graphs, Euler formula for planar graph, Graph coloring, Chromatic polynomial, Map coloring, Four Color Theorem, Five Color Theorem, Matching, Network flow, and its applications, Cut set, Cut vertex, Chord, Properties of Cut Sets, Max Flow Min Cut Theorem.

TEXT BOOKS:

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, 2014.
2. Nasingh Deo, "Graph Theory with Applications to Engineering Computer Science", Prentice-Hall, 2014.

REFERENCE BOOKS:

1. Keneth H Rosen, "Discrete Mathematics and its applications", 5th Edition,, Tata McGraw Hill, 2014.
2. C L Liu, "Elements of Discrete Mathematics", 4th edition, Tata MacGraw Hill 2014.
3. Thomas Khoshy, "Discrete Mathematics with applications", Elsvier, 2012.
4. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Asia, 2015.
5. Frank Harary, "Graph Theory", Norosa, 2013.
6. J. A. Bondy and V. S. R. Murthy,"Graph Theory with Applications", Macmillan, London, 2013.

JOURNALS/MAGAZINES

1. https://www.journals.elsevier.com/discrete-mathematics
2. http://www.math.iit.edu/~kaul/Journals.html
3. https://www.siam.org/publications/journals/siam-journal-on-discrete-mathematics-sidma
4. https://onlinelibrary.wiley.com/journal/10970118
5. https://iopscience.iop.org/article/10.1088/1742-6596/1175/1/012069/meta
6. https://iopscience.iop.org/article/10.1088/1742-6596/1188/1/012065/meta
7. https://www.worldscientific.com/worldscinet/jml
8. https://www.scimagojr.com/journalsearch.php?q=12000154480&tip=sid

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/107/111107058/
2. https://nptel.ac.in/courses/106/103/106103205/
3. https://onlinecourses.swayam2.ac.in/cec20_ma02/preview
4. https://onlinecourses.nptel.ac.in/noc20_ma05/preview
5. https://onlinecourses.swayam2.ac.in/cec20_ma03/preview
6. https://www.coursera.org/learn/graphs

Course Title	Agile Software Development and DevOps				Course Type		Theory	
Course Code	B20CI0304	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

The course provides students with a knowledge on the basic principles of software development life cycle, activities involved in software requirements engineering, software development, testing, evolution and maintenance. It introduces concepts such as software processes and agile methods, and essential software development activities.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the importance of the software development process.
2. Demonstrate the workflow of Automating process.
3. Explain the development of a software using Agile method
4. Illustrate with case study, the importance of DevOps.
5. Discuss about importance of software testing process.
6. Explain essential software development activities.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Apply software development process to solve complex problems of engineering	1	2
CO2	Make use of Agile principle for rapid software development	1,3	3
CO3	Distinguish between the traditional SDLC and agile ALM model for efficient and effective product delivery.	1,3,4	1
CO4	Develop the real-world applications using DevOps tools.	1,3	2,3
CO5	Discuss about importance of software testing process.	4	3
CO6	Explain software development activities.	4,6	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4			√			
CO5				√		
CO6				√		√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1								3		
CO4	1	1	3	2	2									3	3
CO5				2											3
CO6				2		3									3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction Defining the Software Development Process: Goals of Defining the Software Development Process , Why Is Defining the Software Development Process Important? , Where Do I Start?, Explaining the Software Development Lifecycle , Systems versus Software Development Life cycle Defining Requirements, Managing Complexity and Change, Validity of Requirements, Testing Requirements ,Functional Requirements, Nonfunctional Requirements, Epics and Stories, Planning for Changing Requirements , Workflow for Defining Requirements ,Test- Driven Development , Designing Systems ,Software Development ,Testing , Testing the Application ,Testing the Process Itself , Continuous Integration , Continuous Delivery and Deployment , Defining Phases of the Lifecycle ,Documentation Required , DevOps , Communicating with All Stakeholders, Production Support ,Maintenance and Bugfixes, Lifecycle in the Beginning ,Maintenance of the Lifecycle ,Creating the Knowledge Base.

UNIT – 2

Agile Application Life cycle Management: Goals of Agile Application Life cycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD?, Focuson12 Agile Principles, Agile Manifesto, Fixed Time box Sprints, Customer Collaboration, Requirements and Documentation.

UNIT – 3

Automating the Agile ALM: Goals of Automating the Agile ALM, Why Automating the ALMIs Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, What Do I Do Today?, Automating the Workflow, Process Modeling Automation, Managing the Lifecycle with ALM, Broad Scope of ALM Tools ,Achieving Seamless Integration ,Managing Requirements of the ALM, Creating Epics and Stories, Systems and Driven Development, Environment Management, Gold Copies, Supporting the CMDB, Driving DevOps ,Supporting Operations ,Help Desk ,Service Desk ,Incident Management , Problem Escalation ,Project Management, Planning the PMO ,Planning for Implementation, Evaluating and Selecting the Right Tools, Defining the Use Case, Training Is Essential, Vendor Relationships, Keeping Tools Current.

UNIT – 4

DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps inDev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

TEXT BOOKS:

1. BobAiello and LeslieSachs, “Agile Application Life cycle Management Using DevOps to Drive Process Improvement”, Addison Wesly, First printing, 2016.

REFERENCE BOOKS:

1. Roger S, “Software Engineering-A Practitioner’s Approach”, seventh edition, Pressman, 2010.
2. Roger Pressman, Ian sommerville, “Software Engineering”, Pearson,9th edition,2010.
3. HansVanVliet, “Software Engineering: Principles and Practices”, Wiley,2008.
4. Richard Fairley, “Software Engineering Concepts”, McGraw-Hill ,2008
5. ACM Transactions on Software Engineering and Methodology(TOSEM).
6. IEEE Transactions on Software Engineering.

JOURNALS/MAGAZINES

1. Journal of Software Engineering Research and Development
2. International Journal of Agile and Extreme Software Development
3. A decade of agile methodologies: Towards explaining agile software development
4. Journal of Systems and Software

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/course/devops-core-fundamentals
2. https://www.scaledagile.com/certification/courses/safe-devops/
3. https://www.coursera.org/learn/devops-culture-and-mindset
4. https://www.coursera.org/learn/uva-darden-continous-delivery-devops

Self-Learning Exercises:

1. Case study on Critical system
2. Case study on ATM using agile method

Course Title	Management Science				Course Type		Theory	
Course Code	B20MGM301	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**2**	**2**	**26**	**0**	**50**	**50**

COURSE OVERVIEW

The course intends to familiarise students to understand the management principles and applications, which lays a strong foundation for managers and leaders in critical thinking and decisions making process. The course emphasises on giving an overview of the functional area of management

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	To Plan organizational structure for a given context in the organisation carry out production operations through Work-study.	1-5	2
CO2	To carry out production operations through Work-study.	1-5	3
CO3	To Understand the markets, customers and competition better and price the given products Appropriately.	1-5	2
CO4	To Plan and control the HR function better.	1-5	2,3
CO5	To create foundation of decision making process and critical thinking	1-6	3
CO6	To emphasises on giving an overview of the functional area of management	2,4	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	√
CO6		√		√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1									3	
CO4	1	1	3	2	5									3	3
CO5	1	1	2	3	2	2									3
CO6		1		2										3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Management and Organisation: Concepts of Management and organization- nature, importance and Functions of Management. Systems Approach to Management – Taylor's Scientific Management Theory- Taylor's Principles of Management, Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory – Hertzberg Two Factor Theory of Motivation – Leadership Styles, Social responsibilities of Management. Designing Organisational Structures: Basic concepts related to Organisation Depart mentation and Decentralisation.

UNIT – 2

. **Operations and Marketing Management**: Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study –Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering(BPR) Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis. Purchase Procedure, Stores Management and Store Records – JIT System, Supply

Chain Management, Functions of Marketing, Marketing Mix. And Marketing Strategies based on Product Life Cycle. Channels of distribution.

UNIT – 3

Human Resources Management (HRM): Concepts of HRM. HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR.. Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development. Placement, Wage and Salary Administration, Promotion. Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating -Capability Maturity Model (CMM) Levels – Performance Management System.

UNIT – 4

Strategic Management and Contemporary strategic Issues: Mission, Goals, Objectives, Policy, Strategy. Programmes, Elements of Corporate Planning Process, Environmental Scanning. Value Chain Analysis, SWOT Analysis. Steps in Strategy Formulation and implementation, Generic. Strategy alternatives. Bench Marking and Balanced Score and as Contemporary Business Strategies.

TEXT BOOKS:

I. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, New York, 15th Edition, 2012.
2. Koontz and Weihrich: Essentials of management, McGraw Hill, New Delhi, 11th Edition, 2012.

REFERENCE BOOKS:

1. Thomas N. Duening and John M. Ivancevich, Management – Principles and Guidelines, Dreamtech Press; 1st Edition, 2012.
2. Samuel C. Certo, Modern Management, Prentice Hall, New York, 9th Edition, 2012.
3. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, New York, 6th Edition, 2012.
4. John A. Parnell, Strategic Management – Theory and Practice, Cengage Publications, 2018.
5. Lawrence R Jauch, R. Gupta and William F. Glucek: Business Policy and Strategic Management Science, McGraw Hill, New York, 5th Edition, 2012.

Course Title	Environmental Science				Course Type		Theory	
Course Code	B20AS0301	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**2**	**2**	**26**	**0**	**50**	**50**

COURSE OVERVIEW

This course intends to understand, analyze and execute the environmental conditions and the control measures on various types of pollutions can be recognized. This course also talks about the environmental degradation on global warming, acid rain formation, and waste management and how the energy and natural resources can be used effectively in ecosystem.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Graduates will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities.
2. Graduates will have the ability to obtain the knowledge, and will recognize the need for engaging in life-long learning.
3. Will find the need of various types of energy (conventional & non-conventional) resources and natural resources.
4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.
5. Acquire knowledge about sources, effects and control measures of environmental pollution, degradation and waste management.
6. Explore the ways for protecting the environment.

COURSE OUTCOMES (Cos)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	1-5	2
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products.	1-5	3
CO3	Classify different wastes, sources of waste and their effect on population	1-5	2,3
CO4	Get motivation to find new renewable energy resources with high efficiency through active research and innovation and critically analyse the ecological imbalances and provide recommendations to protect the environment.	1-5	2,3
CO5	To learn about increase in population growth and its impact on environment	2,3,4	3
CO6	To Gain knowledge about environment and ecosystem	1-5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4			√			
CO5		√	√	√		
CO6	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1									3	3
CO4	1	1	3	2	5									3	3
CO5		2	2	2											3
CO6	1	2	2	2	2										3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

ENVIRONMENT & ENVIRONMENTAL PROTECTION:

Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

Environmental protection: Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations, Initiative and Role of Non-government organizations in India and world.

UNIT – 2

Environmental pollution, degradation & Waste management:

Environmental Pollution: Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures.

Environmental degradation: Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Waste management: Municipal solid waste, Biomedical waste and Electronic waste (E-Waste).

UNIT – 3

Energy & Natural resources:

Energy: Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy.

Natural resources:

Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance.

Mineral resources - Types of minerals, Methods of mining & impacts of mining activities. Forest wealth - Importances, Deforestation-Causes, effects and controlling measures

UNIT – 4

Ecology, ecosystem & field work:

Ecology-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem - Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity.

Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

TEXT BOOKS:

1. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.
2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2nd Edition, 2014.
3. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.
4. Dr.S.M.Prakash, "Environmental Studies", Elite Publishers, Mangalore, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, New Delhi, 3rd Edition, 2016.
2. Anil Kumar Dey and Arnab Kumar Dey, "Environmental Studies", New age international private limited publishers, New Delhi, 2nd Edition, 2007.
3. Michael Allaby, "Basics of environmental Science", Routledge-Tayler & Francis e-library, New York, 2nd Edition, 2002.
4. Dr.Y.K Singh, "Environmental Science", New age international private limited publishers, New Delhi, 1st Edition, 2006.

Self-Learning Exercises: Need for public awareness on the environment, Gaia Hypothesis

Course Title	ADVANCED KANNADA				Course Type		Theory	
Course Code	B20AHM301	Credits	0		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	-	-	-	-	-	-	-

ರುಕ್ಮಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೇನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು – 560064

ಕನ್ನಡಿಗರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

ಪರಿವಿಡಿ

ಘಟಕ – 1 : **ಕವಿತೆಗಳು**

1. ಬೆಳಗು – ದ ರಾ ಬೇಂದ್ರೆ
2. ಕಲ್ಕಿ – ಕುವೆಂಪು

ಘಟಕ – 2 : **ಕಥೆಗಳು**

3. ಗಾಂಧಿ – ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
4. ಸೆರೆ – ಯಶವಂತ ಚಿತ್ತಾಲ

ಘಟಕ – 3 : **ವಿಜ್ಞಾನ ಲೇಖನಗಳು**

5. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
6. ವೃತ್ತಿಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ – ಎಸ್ ಸುಂದರ್

ಘಟಕ – 4 : ಪರಿಸರ ಲೇಖನಗಳು

7. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ – ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
8. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು – ಪಿ ಲಂಕೇಶ್

- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡಿಗರಿಗೆ **'ಕನ್ನಡ ಕಲಿ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಕನ್ನಡಿಗರಿಗೆ **'ಸಾಹಿತ್ಯ ಸಿಂಚನ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡಿಗರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

Course Title	Basics of Kannada				Course Type		Theory	
Course Code	B20AHM302	Credits	0		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	-	-	-	-	-	-	-

ರುಕ್ಮಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೇನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು – 560064

ಕನ್ನಡೇತರರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

ಭಾಷಾ ಕೌಶಲ್ಯಗಳು

ಘಟಕ – 1

1. ಆಲಿಸುವುದು

- ಆಲಿಸುವ ಕೌಶಲ್ಯ
- ಆಲಿಸುವಿಕೆಯಲ್ಲಿನ ದೋಷಗಳು
- ಉತ್ತಮ ಆಲಿಸುವಿಕೆ

ಘಟಕ – 2

2. ಮಾತನಾಡುವುದು

- ಸಂಭಾಷಣೆ
- ವ್ಯವಹಾರಿಕ ಸಂಭಾಷಣೆ
- ದೋಷಗಳು ಮತ್ತು ಪರಿಹಾರಗಳು

ಘಟಕ – 3

3. ಓದುವುದು

- ಓದು ಕಲಿಸುವಾಗ ಗಮನಿಸಬೇಕಾದ ಅಂಶಗಳು
- ಧ್ವನ್ಯಾಂಗಗಳ ಪರಿಚಯ
- ಓದಿನ ವಿಧಗಳು

ಘಟಕ – 4

4. ಬರೆಯುವುದು

- ವರ್ಣಮಾಲೆಯ ಸ್ವರೂಪ
- ಕಾಗುಣಿತ ಸ್ವರೂಪ
- ಕನ್ನಡ ಸಂಖ್ಯೆಗಳು

- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡೇತರರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡೇತರರಿಗೆ **'ಕನ್ನಡ ಮನಸ್ಸು'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಇವರು **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ ತಂದಿದ್ದಾರೆ.

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

Detailed Syllabus

Semester-4

Course Title	Design and Analysis of Algorithm				Course Type		Theory	
Course Code	B20CI0401	Credits	4		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW

In this course the study of fundamental algorithms to solve a variety of problems, including sorting, searching and graph algorithms are discussed. Techniques for analyzing time and space complexity of algorithms are discussed and hence evaluation of tradeoffs between different algorithms is done.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the mathematical foundation for the analysis of algorithms.
2. Illustrate the algorithms using brute force and divide and conquer design technique.
3. Make use of greedy and dynamic algorithmic design techniques for a given problem.
4. Discuss the problems based on backtracking and branch and bound techniques.

COURSE OUTCOMES (COs):

After the completion o fthe course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of mathematical foundation for the analysis of algorithms.	1 to 5, 12	1,2
CO2	Develop a program to solve the given real world problems using brute force and divide and conquer design paradigm.	1 to 5,12	1,2
CO3	Make use of greedy and dynamic programming techniques for solving the given real world problem.	1 to 5,12	1,2,3
CO4	Utilize backtracking and branch and bound techniques to solve real world problems.	1,to 5,12	1,2,3
CO5	Learn new tools and technologies in the Desiging of algorithms and apply for suitable application development.	12	1
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	1							1	3	3	
CO2	2	2	1	2	2							2	3	3	
CO3	2	2	1	3	2							2	3	3	3
CO4	2	1	1	3	2							1	3	3	3
CO5												3	3		
CO6					3				3	2			3	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction-Notion of an Algorithm; Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms.

UNIT – 2

Brute Force: Bubble Sort, Selection Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search, Divide-and-Conquer: Merge sort, Quick sort, Multiplication of Large Integers, Decrease-and-Conquer- Insertion Sort, Topological Sorting.

UNIT – 3

Greedy Technique-Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm Dynamic Programming- Fibonacci numbers, Binomial coefficient, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms

UNIT – 4

Space and Time Trade-Offs- Sorting by Counting, Input Enhancement in String Matching, Coping with the Limitations of Algorithm Power- Backtracking-n-Queens Problem, Subset-Sum Problem, Branch-and-Bound, Assignment Problem, Travelling Salesman Problem

Exp. No	PROBLEM STATEMENT
1	Search for a given pattern in a text string using Brute Force String Matching.
2	Sort a set of elements in ascending order using Quick Sort algorithm.
3	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's
4	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithms. Differentiate the methods.
5	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra's algorithm
6	Design and Implement 0/1 Knapsack problem using Dynamic Programming.
7	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm
8	Obtain the DFS ordering of vertices in a given digraph.
9	Implement Horspool's algorithm for String Matching and find the number of key comparisons in successful search and unsuccessful search
10	Sort a given set of elements in ascending order which has duplicate entries. Use the sorting by counting algorithm
11	Implement N Queen's problem using Back Tracking.
12	Write a program to sort all transactions of Big Mall by quantity of sales.
13	Write a program to find network of people of same location in Linkedin social network

TEXTBOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson, 3rd Edition, 2012.
2. Ellis Horowitz, Satraj Sahni and Rajasekaran,"Computer Algorithms/C++", Universities Press, 2nd Edition, 2014.
3. Kleinberg, "Algorithm Design", Pearson Education, 1st Edition, 2013.
4. Michael Goodrich, Roberto Tamassia, "Algorithm Design and Applications", Wiley Publishers, 1st Edition, 2014.

REFERENCEBOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", PHI, 3rd Edition,
2. ACM Transactions on Algorithms.
3. ACM Journal of Algorithms and Computational Technology.

JOURNALS/MAGAZINES

1. https://www.mdpi.com/journal/algorithms
2. https://ieeexplore.ieee.org
3. https://www.springer.com/journal/453
4. https://ieeexplore.ieee.org/document/7990553

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.swayam2.ac.in/cec20_cs03/preview
2. https://iiiier.org/NPTEL-Local-Chapter
3. https://www.edx.org/course/algorithm-design-and-analysis

Self-LearningExercises:

1. More exploration on GIThub

Course Title	Unix Operating System				Course Type		Integrated	
Course Code	B20CI0402	Credits	4		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW:

UNIX operating system provides a practical case of operating systems for the user to understand and master deeply and tangibly the theory and algorithms in operating systems. It gives deeper insights into the hierarchical structure, principles, applications, shells, development, and management of the UNIX operation system multi-dimensionally, systematically and from the elementary to the profound. It makes the user to understand about how UNIX operating system functions.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain the history, basics and structure of UNIX Operating System
2. Describe UNIX process concepts and scheduling techniques
3. Illustrate the use of different memory management techniques of UNIX.
4. Describe UNIX kernel, data structures and internal representation of files in UNIX operating system

COURSE OUTCOMES (COs):

After the completion of the course, the students will beableto:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the history of UNIX environment and its software architecture.	1,2,5	1,3
CO2	Develop the programs to implement the different process states, attributes and control the process in foreground and background.	1,4,5	1,3
CO3	Compare and analyze the performance of different memory management techniques.	1,4,5	2,3
CO4	Make use of UNIX file types, file structure and file system implementation.	1,2,4, 5	1,3
CO5	Learn new tools and technologies in the Desiging of algorithms and apply for suitable application development.	12	1
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3				√		
CO4			√			
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			1								3		3
CO2	3			3	3								3		3
CO3	3			3	3									3	3
CO4	3	3		3	2								3		3
CO5												2	3		
CO6					3				3	3			3	2	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – 1

Background of UNIX Operating System: Introduction of Operating System, Types of UNIX, History of UNIX, UNIX Software Architecture: System Call Interface, Standard Libraries and Language Libraries, UNIX Shell, Applications, UNIX Environment, Character User Interface Versus Graphical User Interface, UNIX Command Lines.

UNIT – 2

UNIX Process Management: Multiple Processes Running Concurrently: Fundamental Concept for Scheduler and Scheduling Algorithm, UNIX Scheduling Algorithm and Context Switch, Process States, Process Image and Attributes, Process Control: Running Command in Foreground or in Background, More Concepts about Process Concurrently, Execution in UNIX, UNIX Inter-Process Communication, UNIX Signals, Termination of Processes, Daemons UNIX Background "Guardian Spirits", UNIX System Boot and Init Process.

UNIT – 3

UNIX Memory Management: Outline of Memory Management: Memory Allocation Algorithms in Swapping, Page Replacement Algorithms in Demand Paging, Process Swapping in UNIX: Swapped Content, Timing of Swapping, Allocation Algorithm, Selection Principle of Swapped Processes, Swapper, Swapping Effect, Demand Paging in UNIX: Demand Paging, Page Replacement.

UNIT – 4

UNIX File System: UNIX File System Structure: File System Organization, Home and Working Directories, Absolute and Relative Pathnames, UNIX Inodes and Data Structures for File System, UNIX File Concept and Types of Files, Managing Files and Directories : Displaying Pathname for Home Directory and Changing Directories, Viewing Directories and File Attributes, Creating Directories and Files, Displaying Type of a File, File and Directory Wildcards, UNIX File Storage and File System Implementation.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			
1.	a) Execute at least ten UNIX shell commands on the terminal and the use of the shell commands.	Linux OS	Shell commands.
	b) Write a C/C++ program to display the output of any UNIX shell command.	Linux OS	
2.	a) Write a C/C++ program to create a sub process by printing its pid and the main process pid value.	Linux OS	Process Control.
	b) Write a C/C++ program to show the process is an orphan process and print its parent pid value.		
3.	a) Write a C/C++ program that creates a zombie and then calls system to execute the ps command to verify that the process is zombie.	Linux OS	Zombie Process.
	b) Write a C/C++ program to avoid zombie process by forking twice.		
4.	a) Write a C/C++ program that outputs the contents of its Environment list.	Linux OS	Process Control.
	b) Write a C/C++ program to illustrate the race condition.		
5.	a) Write a C/C++ to create hard link and soft link and display the hard link count with other attributes of the created file within the sample code.	Linux OS	File Types and File attributes

	b) Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.		
6.	a) Write a C/C++ program which demonstrates Interprocess communication between a reader process and a writer process of a FIFO file by using the corresponding API's.	Linux OS	Inter Process Communication.
	b) Write a C/C++ program which demonstrates the signal handler function to handle the signal sent by the process.		UNIX signals.
	Part-B (Mini Project: Bank Management System)		
	Bank System is based on the concept of recording customer's account details. The system contains only the admin section. Here the admin can perform all the tasks like creating an account, deposit and withdraw amount, check balance, view all account holder. It contains the following modules of account creation. 1. Customer Module 2. Transaction Module	Linux OS	Modules of Bank Management System
1	Write a C++ program to create account of a customer of Bank Management System and display the contents.	Linux OS	Create a class bank to create account and display the contents.
2	Write a C++ program to close or delete an account of a created customer accounts of Bank Management System.	Linux OS	To close an existing account.
3	Write a C++ program to display all account holders of a created customer accounts of Bank Management System.	Linux OS	To display all account holders.
4	Write a C++ program to modify an account of a created customer accounts of Bank Management System.	Linux OS	To modify account and display the contents.
5	Write a C++ program to deposit amount of a created customer account of bank Management System and display the contents	Linux OS	To deposit amount and display the contents.
6	Write a C++ program to deposit and withdraw amount of a created customer account of bank Management System and display the contents.	Linux OS	To withdraw amount and display the contents.
7	Write a C++ program to check the balance amount of a created customer account of bank Management System and display the contents.	Linux OS	To check balance and display the contents.
8	Write a C++ program to intergrate the above modules scenario and display each module contents.	Linux OS	Complete knowledge of the project.

TEXTBOOKS:

1. Yukun Liu, Yong Yue ,Liwei Guo, “UNIX Operating System: The Development Tutorial via UNIX Kernel Services”, Springer, Higher Education Press, 2011.
2. Maurice J. Bach, “The Design of the UNIX Operating System; Pearson Education”, Prentice Hall of India, 2004.

REFERENCE BOOKS:

1. William Stallings, ”Operating Systems: Internals and Design Principles”, Prentice Hall of India, seventh edition 2011.
2. D. M. Dhamdhere, ”Operating Systems: A Concept-Based Approach”, Tata McGraw-Hill,2002.
3. Gary J. Nutt, ”Operating Systems: A Modern Perspective”, Addison-Wesley, 2011.

JOURNALS/MAGAZINES

1. https://link.springer.com/chapter/10.1007/978-3-030-02619-6_53
2. https://link.springer.com/chapter/10.1007/978-3-642-88049-0_25
3. https://link.springer.com/chapter/10.1007/978-3-642-20432-6_1

SWAYAM/NPTEL/MOOCs:

1. Coursera – The UNIX Workbench
2. Coursera – Practical Introduction to the Command line
3. https://www.edx.org/course/linux-basics-the-command-line-interface
4. https://www.edx.org/course/introduction-to-linux

Self-LearningExercises:

1. Basic Shell commands
2. Usage of vi and gedit text editors
3. UNIX I/O system and redirection
4. C modules interface

Course Title	Database Management System				Course Type		Integrated	
Course Code	B20CI0403	Credits	4		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50**	**50**

COURSE OVERVIEW:

This course introduces topics such as conceptual data modelling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain the basics of Database Management System.
2. Demonstrate the use of Relational model and Relational algebra.
3. Illustrate the use of different SQL statements.
4. Discuss the topics such asDatabase Design and Normalization.

COURSE OUTCOMES(COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1,to 5,12	1,2
CO5	Learn new tools and technologies in DBMS and apply for suitable application development.	12	1
CO6	Develop solutions and create better database, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2					1		1	3	3	
CO2	3	3	2	3	1							1	3	3	
CO3	3	3	2	3	3							1	3	3	3
CO4	3	3	2	3	1							1	3	3	
CO5												3	2		
CO6					2				3	2			3	3	

Note: 1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to databases and Conceptual Modelling: Introduction to database, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues. Introduction to various database tools and framework (commercial and open source)

UNIT – 2

Relational Data Model and Relational algebra: Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra.

UNIT – 3

SQL: SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, Retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.

UNIT – 4

Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, and Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

PRACTICE:

S.No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1	Consider the following schema for Order Database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted	SQL PLUS	Solving queries using SQL
2	Specify the following queries on the Flight relational database schema using SQL Flights(*flno:* integer, *from:* string, *to:* string, *distance:* integer, *departs:* time, *arrives:* time) Aircraft(*aid:* integer, *aname:* string, *cruisingrange:* integer) Certified(*eid:* integer, *aid:* integer) Employees(*eid:* integer, *ename:* string, *salary:* integer) 1.Find the eids of pilots certified for some Boeing aircraft. 2. Find the names of pilots certified for some Boeing aircraft. 3. Find the aids of all aircraft that can be used on non-stop flights from Bonn to Madras. 4. Identify the flights that can be piloted by every pilot whose salary is more than $100,000. 5. Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft. 6. Find the eids of employees who make the highest salary. 7. Find the eids of employees who make the second highest salary.	SQL PLUS	Solving queries using SQL

3	Solve the below queries by using SQL Student(snum, sname, major, level, age) Class(cname, meets at, room, fid) Enrolled(snum, cname) Faculty(fid, fname, deptid) The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Queries 1. Find the names of all juniors (Level = JR) who are enrolled in a class taught by I. Teacher. 2. Find the age of the oldest student who is either a History major or is enrolled in a course taught by I. Teacher. 3. Find the names of all classes that either meet in room R128 or have five or more students enrolled. 4. Find the names of all students who are enrolled in two classes that meet at the same time. 5. Find the names of faculty members who teach in every room in which some class is taught. 6. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five. 7. Print the Level and the average age of students for that Level, for each Level. 8. Print the Level and the average age of students for that Level, for all Levels except JR. 9. Find the names of students who are enrolled in the maximum number of classes. 10. Find the names of students who are not enrolled in any class.	SQL PLUS	Solving queries using SQL

4	Solve the below queries by using SQL branch (branch-name, branch-city, assets) customer (customer-name, customer-street, customer-city) account (account-number, branch-name, balance) loan (loan-number, branch-name, amount) depositor (customer-name, account-number) borrower (customer-name, loan-number) employee (employee-name, branch-name, salary) 1. Find the names of all customers. 2. Find the names of all branches in the loan relation, don't display duplicates. 3. Display the entire Branch table. 4. Find the account number for all accounts where the balance is greater than $700. 5. Find the account number and balance for all accounts from Brighton where the balance is greater than $800. 6. Display the branch name and assets from all branches in thousands of dollars and rename the assets column to 'assets in thousands'. 7. Find the name of all branches with assets between one and four million dollars. 8. Find the name, account number, and balance of all customers who have an account. 9. Find the name, account number, and balance of all customers who have an account with a balance of $400 or less.	SQL PLUS	Solving queries using SQL
5	Consider the following schema for a Library Database: BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Branch_id, No-of_Copies) BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH (Branch_id, Branch_Name, Address) Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.	SQL PLUS	Solving queries using SQL

TEXTBOOKS:

1. Elmasri and Navathe, “Fundamentals of Database Systems”, Pearson Education, 5th Edition, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, McGraw-Hill, 3rd Edition, 2003.
3. Phill Pratt, “Concepts of Database Management, Cengage Learning”, 8th Edition, 2014
4. Jeffrey A Hoffer, “Modern Database Management, Pearson”, 12th Edition, 2015

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: “Database System Concepts”, 6th Edition, McGraw Hill, 2010.
2. C J Date, “Database Design and Relational Theory: Normal Forms and All that Jazz”, O ‘Reilly, April 2012.
3. James Martin, “Principles of Database Management Systems”, 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering
5. Elsevier Data and Knowledge Engineering
6. ACM Transactions on Database Systems

JOURNALS/MAGAZINES

1. http://www.ijstr.org/final-print/june2019/Database-Management-System.pdf
2. https://www.dbjournal.ro/

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/courses?query=database%20management
2. https://onlinecourses.swayam2.ac.in/cec19_cs05/preview
3. https://www.edx.org/learn/databases
4. https://www.classcentral.com/course/swayam-data-base-management-system-9914

Self-Learning Exercises:

1. MONGODB
2. Transaction and concurrency control
3. UML

Course Title	Computer Organization and Architecture				Course Type		Integrated	
Course Code	B20CJ0401	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

Computer organization and architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, student will learn the basics of hardware components from basic arithmetic units to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain architecture of ARM processor and write simple assembly programs.
2. Demonstrate the translation of assembly instructions into their binary representation.
3. Describe and understand the processor memory hierarchy.
4. Discuss basic understanding of interrupts, I/O devices, and I/O protocols

COURSE OUTCOMES(COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of ARM processor instruction set for developing simple assembly programs.	1,2,7,12	1
CO2	Interpret the functional architecture of computing systems.	1,2,4,10	1
CO3	Identify the issue related to instruction set architecture, memory unit and control unit and I/O functions.	1,11	1
CO4	Develop a real world application using parallel processing concepts.	1,2,4,10,11	1,2
CO5	Learn new tools and technologies and apply for suitable application development.	12	1
CO6	Develop solutions in the Computer Architecture and Organization to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 6, 10	1, 2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3					3					1	3		
CO2	3	3		2						2			3		
CO3	3										2		3		
CO4	3	3		2						2	2		3	3	
CO5												1			
CO6					1				1	1			1	1	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to ARM processor: Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer and Internet of Things (IoT). ARM characteristics, Register structure, Addressing modes, Instructions, Assembly language, Operating Modes and Exceptions, Conditional execution of Instructions.

UNIT – 2

Arithmetic unit: Addition and Subtraction of Signed Numbers**,** Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations, Arithmetic operations on floating point numbers.

UNIT – 3

Memory System: Basic concepts, Synchronous RAM memories, Read-only memories, Direct Memory Access, Memory Hierarchy, Cache memories, Virtual memory.

UNIT – 4

Input/output Organization: Bus structure, Bus operation, Arbitration, Interface circuits, Intercommunication standards.

Parallel processing: Hardware multithreading, Vector (SIMD) processing and Shared Memory multiprocessors.

TEXTBOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, “Computer Organization and Embedded Systems”, Sixth Edition, McgraHIll.

REFERENCEBOOKS:

1. Linda Null, Julia Labor, “The Essentials of Computer Organization and Architecture”, Viva Publishers, 4th Edition, 2015.
2. William Stallings. “Computer organization and architecture: designing for performance”. Pearson Education India, 2000.
3. David A. Patterson, John L. Hennessy. “Computer organization and design: the Hardware/software interface”. Elsevier, 2011.
4. Peter Knaggs, “ARM Assembly Language Programming”, April 2016.

JOURNALS/MAGAZINES

1. https://engineering.lehigh.edu/cse/academics/course-index/cse-202-computer-organization-and-architecture-3
2. https://www.computer.org/csdl/magazine/co/1977/12/01646340/13rRUwInvnA
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10208

SWAYAM/NPTEL/MOOCs:

1. https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824
2. https://onlinecourses.nptel.ac.in/noc20_cs25/preview
3. https://www.edx.org/course/computation-structures-2-computer-architecture-2

Self-LearningExercises:

1. Intel IA-32 architecture, Instruction Set Architecture of IA-32, Basic Input/Output, Basic processing unit and Pipelining.

Course Title	Numerical Methods and Optimization Techniques				Course Type		Theory	
Course Code	B20AS0401	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Numerical Methods and Optimization Techniques emphasizes on the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand the guaranteed accuracy that various methods provide, the efficiency and scalability for large scale systems and issues of stability. Optimization Techniques provide ability to solve real-world problems by finding the optimal solutions to the models subject to constraints.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain numerical methods to obtain approximate solutions to mathematical problems.
2. Examine numerical methods for various mathematical operations and tasks, such as interpolation and integration.
3. Illustrate the notation of vector spaces, sub spaces, linear independence, coordinate and change of coordinate.
4. Solve linear programming problems considering Transportation and Assignment Problems.

COURSE OUTCOMES(COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply numerical methods to obtain approximate solutions for mathematical problems.	1 to 3, 12	1
CO2	Determine suitable interpolation formula and quadrature formulae to find the solution for the given data.	1 to 4 ,12	2
CO3	Solve the matrix associated with liner transformation with respect to the given base and understand the relationship between the operation and linear transformations and their corresponding matrices.	1 to 5,	3
CO4	Develop mathematical equations with simplex method and Transportation-Assignment problem for linear programming	1 to 5,12	1,2,3
CO5	Learn new tools and technologies in the Numerical Methods and apply for suitable application development.	12	
CO6	Develop solutions in the Numerical Methods to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			
CO5			√			
CO6			√		√	

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									1	3		
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1			3
CO4	3	3	3	3	3							1	3	3	3
CO5												2			
CO6					2	3				3					

Note: 1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – 1

Numerical Methods: Errors in Numerical Calculations Types of Errors-Significant Digits-Programming Errors- Numerical Solution of Non-Linear Equations-Bisection Method-Regula Falsi Method-Newton Raphson Method –Fixed Point Method of Iteration – Rates of Convergence of These Methods. Solutions of Algebraic Equations, Relaxation Method and Gauss Seidel Iteration Method.

UNIT – 2

Numerical Analysis: Finite Differences-Operators (Δ, ∇ and E), Interpolation, Newton-Gregory Forward Interpolation Formula, Central Difference, Stirling And Bessel's Interpolation Formulae, Lagrange's Interpolation Formula, Inverse Interpolation Formula, Divided Difference Formula, and Newton's Divided Differences Formula**.** Numerical integration**:**Newton-Cotes quadrature formulae: Trapezoidal, Simpson's rules and Weddle's rule.

UNIT – 3

Vector Spaces and Linear transformations: Bases, Echelon forms, Rank, and determinants. Gauss elimination and its complexity, Inner products, Gram-Schmidt orthogonalization. Linear transformations.

UNIT – 4

Linear Programming: Introduction, Canonical and Standard Form of LPP-Simplex Method-Big M Method- Two Phase Method-Principle of quality-Dual Simplex Method. Transportation Problem and Assignment problem.

TEXTBOOKS:

1. Sastry S.S., "Numerical Analysis", Prentice-Hall India (module I), 4th edition
2. K. Hoffman and R. Kunze," Linear Algebra", Prentice-Hall India, 1971.
3. R Panneerselvam," Operations research", 2nd edition, PHI

REFERENCES

1. KanthiSwarup, P.K. Gupta, Man Mohan, "Operations research", Sultan Chand & Sons. (module II), 5th edition.
2. Froberg, "Introduction to Numerical Analysis", Second Edition, Addition Wesley
3. Gerald and Wheatley, "Applied Numerical Analysis", Pearson Education Asia, Sixth Edition
4. S.S Rao, "Optimization Theory and Applications", Wiley Eastern
5. Grawin W. W, "Introduction of Linear Programming", McGraw Hill.
6. M. K. Jain, S. R. K. Iyengar and R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th edition, 2012.

JOURNALS/MAGAZINES

1. https://onlinelibrary.wiley.com/journal/10970207
2. https://www.springer.com/journal/245
3. https://ijnao.um.ac.ir/
4. https://www.scimagojr.com/journalrank.php?category=2612

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/108/106108056/
2. https://www.coursera.org/learn/intro-to-numerical-analysis
3. https://nptel.ac.in/courses/122/102/122102009/
4. https://nptel.ac.in/courses/122/106/122106033/
5. https://www.edx.org/course/convex-optimization

Self-LearningExercises:

1. Optimization Methods for Business Analytics
2. Numerical Methods and Optimization in Finance

Course Title	THEORY OF COMPUTATION				Course Type		Theory	
Course Code	B20EJ0402	Credits	3		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	3	3	3	39	0	50	50

COURSE OVERVIEW:

The course introduces some fundamental concepts in automata theory and formal languages including finite automaton, regular expression, formal language, grammar, pushdown automaton, and Turing machine. These form basic models of computation; they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the concepts of Deterministic and Non-Deterministic Finite Automata.
2. Demonstrate the use of regular expressions for constructing DFA and NFA.
3. Illustrate the construction of context free grammar for a given language.
4. Describe computing Machine including PDA and Turing Machine.
5. Analyse concepts relating to the theory of computation and computational models including decidability and intractability.
6. Design grammars to produce strings from a specific language.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the Finite State Machine by applying the concepts of DFA and NFA.	11 , 12	1
CO2	use of regular expressions for constructing DFA and NFA.	11,12	2
CO3	Identify ambiguity in grammar and Construct CFG for the given	11, 12	3
CO4	Apply the concepts of Push down Automata and Turing machine	11,12	2
CO5	Analyse concepts relating to the theory of computation and computational models including decidability and intractability.	11,12	1
CO6	Design grammars to produce strings from a specific language.	11,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3			√			
CO4			√			
CO5				√		
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1						1	1	3		
CO2	2	2	1	1	1						1	1		3	
CO3	2	2	1	1	1						1	1			3
CO4	2	2	1	1	1						1	1		3	
CO5	2	2	1	1	1						1	1		3	
CO6	3	2	1	1	1						1	1		3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONT
THEORY

Contents
UNIT-1
Introduction to finite automata: Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata
UNIT-2
Regular Expressions, regular languages and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;
UNIT-3
Context free Grammars and Normal forms: Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.
UNIT-4
Push Down Automata and Turing Machine: Push down automata (PDA); Languages of a PDA; Deterministic PDA; Turing Machine.

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2009.
2. Peter Linz, An Introduction to formal Languages and Automata, 4/ E, Jones and Bartlett Publishers, 2006.

REFERENCE BOOKS:

1. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson, 2009.
2. B N Srinivasa Murthy, Formal Languages and Automata Theory, Sanguine Publishers, 2006.

JOURNALS/MAGAZINES

1. https://theoryofcomputing.org/
2. https://www.journals.elsevier.com/theoretical-computer-science
3. https://www.springer.com/journal/224

SWAYAM/NPTEL/MOOCs:

1. https://www.edx.org/course/automata-theory
2. https://nptel.ac.in/courses/106/104/106104028/
3. https://ocw.mit.edu/courses/mathematics/18-404j-theory-of-computation-fall-2006/syllabus/

Self-Learning Exercises:

1. Applications of Finite Automata and Applications of Regular Expressions.

Course Title	Communication Skills				Course Type		Theory	
Course Code	B20AH0301	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	2	2	2	26	0	50%	50%

COURSE OVERVIEW:

This course is aimed to develop basic communication skills in English in the learners, to prioritize listening and reading skills among learners, to simplify writing skills needed for academic as well as workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Develop basic communication skills in English.
2. Emphasize on the development of speaking skills amongst learners of EngineeringandTechnology
3. Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

COURSE OUTCOMES(Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using	1 to 3, 12	1,3
CO2	Build inferences from the text.	1 to 4 ,12	2
CO3	Makeuseofaccuratewritingskillsusingdifferentcomponentsof academicwriting.	1 to 5,12	2
CO4	Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideaslogically on a topic	1 to 5,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									1	3		1
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1		2	
CO4	3	3	3	3	3							1		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

FunctionalEnglish: Grammar: Prepositions; Modal Auxiliaries, Reading Comprehension, Active and passive voice, Giving Instructions.

UNIT – 2

Interpersonal Skills: Grammar: Tenses; Wh-questions, Compound words; Phrasal verbs, Recommendations

UNIT – 3

Multi tasking Skills Grammar: Conditional Sentences, Homonyms; homophones, Subject-verb agreement.

UNIT – 4

Communication Skills Grammar: Direct and indirect speech, Interpreting visua lmaterials (linegraphs, pie charts etc.), Single word substitutes.

TEXT BOOKS:

1. Green, David. Contemporary English Grammar Structures and Composition, NewDelhi: MacMillan Publishers, 20l0,
2. Thorpe, Edgar and Showick, Basic Vocabulary. Pearson Education India, 20l2.
3. Leech, Geoffrey and JanSvartvik, A Communicative Grammar of English, Longman,2003.

REFERENCES:

1. Murphy,Raymond " Murphy's EnglishGrammar with CD", Cambridge University Press,2004.
2. Rizvi, M.Ashraf, "EffectiveTechnicalCommunication", NewDelhi, TataMcGraw-Hill, 2005.
3. Riordan,Daniel, "Technical Communication", NewDelhi:CengagePublications,20ll.
4. Senetal, "CommunicationandLanguage Skills" Cambridge University Press, 2015.

Course Title	Indian Constitution and Professional Ethics				Course Type		Theory	
Course Code	B20LS0301	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**2**	**2**	**26**	**0**	**50**	**50**

COURSE OVERVIEW

The Constitution of India lays down in defining fundamental political principles, establishes the structure, procedures, powers and duties of government institutions and sets out fundamental rights, directive principles and duties of citizen. It helps to know and understand the human rights and human values. It also helps to know the meaning of ethics and need of ethics in personal and professional life.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain basic knowledge required to understand Constitution of India.
2. Describe the Fundamental Rights, Duties and other Rights.
3. Discuss different types of ethics.
4. Explore ethical standards followed by different companies.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.	1 ,6,7,8,9, 12	1,3
CO2	Demonstrate the practicality of Constitution perspective and make them face the world as a bonafide citizen.	1 to 4,7,8 ,12	2
CO3	Illustrate the professional ethics and human values.	1 to 5, 7,8 ,12	2
CO4	Summarize ethical standards followed by different companies.	1 to 5,7,8,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2	2	2	2			1	3		1
CO2	3	3	3	3			3	3				1		3	
CO3	3	3	3	3	3		3	3				1		2	3
CO4	3	3	3	3	3		3	3				1		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Indian constitution: Sailent features, fundamental rights and duties (Directive principle and statepolicy), Legislature (Loka Sabha &Rajya Sabha), Executive (President& Governor) and Judiciary (Supreme court & high court), Composition and function of parliament, Council of ministers, prime minister, Speaker, Passing of bills.

UNIT – 2

Human Rights: Nature and Scope of human rights, Universal protection of human rights (UDHR), Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups (children, women & old-age).

Human values: Truth, Honesty, Loyalty, Love, Peace with examples, Difference between ethics, beliefs and morals.

UNIT – 3

Ethics: Meaning, Definition, Evolution, Need of ethics, Aristotlean Ethics, Utilitarianism, Katianism, human values (Good conduct, respect for elders), ethical human conduct (Gender equality), Professional Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

UNIT – 4

Engineering Ethics: Definition Scope and needs, Ethics in Consumer Protection, Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics. Best Ethical Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence

TEXT BOOKS:

1.Kapoor, S.K., “Human rights under International Law and Indian Law”, Prentice Hall of India, New Delhi, 2002.

2. Basu, D.D., “Indian Constitution”, Oxford University Press, New Delhi, 2002.

3. Chakraborty, S.K., “Values and ethics for Organizations and Theory Practice”, Oxford University Press, New Delhi, 2001.

REFERENCES BOOKS:

1. Meron Theodor, “Human Rights and International Law Legal Policy Issues”, Vol. 1 and 2, Oxford University, Press, New Delhi, 2000.

2. M V Pylee, “An Introduction to Constitution of India”, S Chand & Company, 5th Edition

3. Durga Das Basu, “Introduction to constitution of India”, LexisNexis, 23rd Edition.

SELF-LEARNING EXERCISES:

Abuse of Technologies: Hacking and other crimes, addiction to mobile phone usage, video games and social networking websites

Course Title	Universal human values				Course Type		Theory	
Course Code	B20AHM401	Credits	0		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**0**	**0**	**0**	**0**	**0**	**50%**	**50%**

COURSE OVERVIEW

Universal human values help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	1 to 3, 12	1,3
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	1 to 4 ,12	2
CO3	Understand the role of a human being in ensuring harmony in society and nature.	1 to 5,12	2
CO4	Demonstrate the role of human being in the abetment of pollution	1 to 5,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									1	3		1
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1		2	3
CO4	3	3	3	3	3							1		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

UNIT – 2

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

UNIT – 3

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT – 4

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

TEXTBOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010

2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.

3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010

4.Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

REFERENCE BOOKS:

1. Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997

2. I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970

3. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993

4. William Lilly, Introduction to Ethics, Allied Publisher, London, 1955

Detailed Syllabus
Semester -5

Course Name	Web Technologies & Applications				Course Type		Theory	
Course Code	B20EJ0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

The basics of Web application tools such as HTML, XHTML and CSS are introduced. The course also provides knowledge about advanced research topics such as XML, Perland PHP.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Understand the various steps in designing a creative and dynamic website.
2. Describe the hierarchy of objects in HTML and XML.
3. Design dynamic and interactive web pages by embedding Java Script code in HTML.
4. Illustrate the advantages and use of different types of CSS.
5. Examine the HTML. Know how to use Dynamic HTML.
6. Familiarize server side scripting language like Perl &PHP.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user- friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2,3
CO4	Apply Java Script to develop the dynamic web pages and use server side Scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Examine the HTML .Know how to use Dynamic HTML.	2,3,4,5	2,3
CO6	Familiarize server side scripting language like Perl & PHP.	2-5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√	√	√	√	
CO6		√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	1
CO4	1	2	3	1							1	1		2	1
CO5		2	2	3	1									2	2
CO6		1	2	3	1								1	2	

Note:1-Low,2-Medium,3-High

Course Contents

Theory

Contents
UNIT-1
Web Essentials: Clients, Servers, and Communication. The Internet- Basic Internet Protocols -The World Wide Web- HTTP request message- response message-Web Clients Web Servers-Case Study. Mark up Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements- Relative URLs- Lists- tables- Frames- Forms XML Creating HTML Documents. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Name spaces Java Script and XML

UNIT-2
Style Sheets: Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution. Java script: Over view of Java script, Object orientation and Java script, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors.
UNIT-3
Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; Cookies. Data base access with Perl and MySQL
UNIT-4
Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, Altering tables, queries, deleting database, deleting data and tables.

TEXT BOOKS:

1. Robert.W. Sebesta,"Programming the World Wide Web",Fourth Edition,Pearson.
2. Education,2007 Jeffrey C. Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2006.

REFERENCE BOOKS:

1. Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, PearsonEducation,2006.
2. Marty Hall and Larry Brown, “Core Web Programming” Second Edition, Volume I and II, PearsonEducation,2001.
3. Bates,“DevelopingWebApplications”,Wiley,2006.

JOURNALS/MAGAZINES:

1. International Journal of WebTechnology-ISSN:2278-2389
2. International Journal of Web & Semantic Technology (IJWesT)
3. ELSEVIER Journals with in "Internet And Web Technology”

SWAYAM/NPTEL/MOOCS:

1. Coursera-Web Design: Wire frames to Prototypes
2. Coursera–Web Application Technologies and Django
3. https://nptel.ac.in/courses/106/105/106105084/
4. https://www.edx.org/learn/web-development

SELF LEARNING EXERCISES: HTML5, JQuery, XML, Ruby, Introduction to REST and REST ful API

Course Title	COMPUTER NETWORKS				Course Type		Theory	
Course Code	B20CI0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

The main emphasis of this course is on the organization and management of local area networks (LANs). The course description include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and about Open Systems Interconnection (OSI) communication model with TCP/IP protocol; This course provides knowledge of error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login Protocols.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication.
2. Discuss the MAC protocols, error detection & correction strategies for data transmission over the networking devices.
3. Describe the standards for data communication with routing protocols.
4. Illustrate the client server communication using TCP or UDP protocols and other application level protocols

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1 to 6, 12	2
CO2	Discover the good network design with simplicity, scalability, performance and the end-to-end principle	1 to 6, 12	2
CO3	Appraise the working principles of Internet.	1 to 6, 12	3
CO4	Compile the effectiveness of existing or similar network protocols.	1 to 6, 12	3
CO5	Design a component or a product applying all the relevant standards and with realistic constraints	5,6,9,10	2
CO6	Compare various congestion control mechanisms and identify appropriate Transport layer protocol for real time applications	5,6,9,10	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√	√		
CO3			√	√	√	
CO4			√	√	√	√
CO5			√			
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1						1		3	
CO2	3	3	3	3	2	2						1		3	
CO3	3	3	3	3	2	1						2			3
CO4	3	3	3	2	2	1						1			3
CO5					2	3			2	3				3	
CO6					2	3									3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Data Communication and Networking: Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols & Standards. **Layered Architectures:** Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing. **Introduction to switching:** Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, **Physical Layer:** Introduction to Transmission Media, Periodic Analog signals, Digital signals, Nyquist bit rate, shanon capacity, performance, PCM, DM, Parallel transmission, serial transmission, ASK, FSK, PSK, QAM, AM, FM, PM. **Introduction to Network Tools:** WireShark, Packet Tracer, NS3, etc. **Introduction to Data Communication and Networking:** Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols & Standards.

Layered Architectures: Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing. **Introduction to switching:** Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, **Physical Layer:** Introduction to Transmission Media, Periodic Analog signals, Digital signals, Nyquist bit rate, shanon capacity, performance, PCM, DM, Parallel transmission, serial transmission, ASK, FSK, PSK, QAM, AM, FM, PM. **Introduction to Network Tools:** WireShark, Packet Tracer, NS3, etc.
UNIT-2
Coding: Line Coding. Introduction to Multiplexing: FDM, WDM, TDM, FHSS, DSSS. **Error Detection and Correction:** Introduction, cyclic Codes: CRC, Internet checksum. Framing, Data Link Protocols: Point-to-Point Protocol. **MAC Protocols:** classification of MAC protocols, Random access (ALOHA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token passing), Channelization Protocols (FDMA, TDMA, CDMA) **Introduction to Networking Devices:** Repeaters, Hubs, Bridges, Routers, and High layered switches, Gateways, Virtual LAN.
UNIT-3
Standards: IEEE Standards, Standard Ethernet, Gigabit Ethernet. IEEE 802.11: Architecture, MAC Sub layer, Addressing Mechanism. **Network Layer:** IPv4 addresses, IP Datagram format, ICMP Messages, Introduction to Mobile IP for mobility management, IPv6 addresses, IPv6 Packet Format, Transition from IPv4 to IPv6, Routing algorithms (Distance Vector, Link State and Path vector), Unicast Routing protocols(RIP, OSPF). Awareness on BGP, Introduction to Multicasting protocols, brief introduction to multicast protocols such DVMRP, MOSPF, PIM.
UNIT-4
Transport Layer: Introduction to Stop and Wait, GoBack-N, Selective repeat N, Piggybacking. Services and port numbers, User Datagram Protocol (UDP): UDP Segment, Transmission Control. Protocol (TCP): TCP Segment, TCP Connection Set up, Application of TCP and UDP. TCP flow control, TCP error control, TCP Congestion Control and options. Introduction to SCTP services and features. **Application Layer:** Client server programming using UDP and TCP, DNS, SMTP. Introduction to Remote Login Protocols: TELNET Protocol and SSH Protocol.

TEXT BOOKS:

1. Behrouz A Forouzan: Data Communications and Networking, 5th Edition, McGraw – Hill, 2016.
2. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2009

REFERENCE BOOKS:

1. Alberto Leon-Garcia and Indra idjaja: Communication Networks – Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw – Hill, 2004.
2. Andrew S. Tanenbaum: Computer Networks, 4th Edition, Pearson Education, 2005.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks- A system Approach, 5th Edition, Elsevier, 2012.
4. William Stallings: Data and Computer Communications, 10th Edition, Pearson Education, 2008.
5. Douglas E. Comer: Internetworking with TCP/IP Vol.1, 6th Edition, Pearson, 1995.
6. Design and develop an application using the different available RESTFul Web Services.

JOURNALS/MAGAZINES

1. IEEE Transactions on Networking.
2. Elsevier Journal of Computer Networks

3. Springer Journal of communications and Information networks.

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/topic/computer-network/
2. https://www.coursera.org/courses?query=computer%20network
3. https://nptel.ac.in/courses/106/105/106105183/
4. https://www.edx.org/learn/computer-networking

SELF-LEARNING EXERCISES:

Wifi, WiMAX, 4G, 5G, Satellite Networks, MPLS, VPN, ATM. Bluetooth Architecture. World Wide Web (WWW).

Course Title	**MACHINE LEARNING**				**Course Type**		**Theory**	
Course Code	B20CI0502	**Credits**	**3**		**Class**		**V semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain machine learning and problems relevant to machine learning.
2. Discuss the fundamentals of Decision trees learning and its issues
3. Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.
4. Describe statistical analysis of machine learning techniques.

COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design the learning system to provide the solution for the given problem.	1 to 5	1,2
CO2	Apply Decision Tree technique for Classification problem	1 to 5	1,2
CO3	Develop Recognition or Prediction systems using Neural Network / Bayesian Model	1 to 5	2,3
CO4	Solve the problem by hypothesis testing using probability and statistics.	1 to 5	2,3
CO5	Understandability of technological enhancement via improvising versions of machine learning knowledge transfer learning and deep learning	10,12	2,3
CO6	Analysing the influence of extended machine learning terminologies vis lifelong learning	11,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√		√		
CO6				√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3

CO4	3	2	2	2	2								3	3	3
CO5	3	3	3	2	2					2		3		2	2
CO6	3	2	2	3	2						3	3		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

THEORY

Contents
Unit-1: **Introduction to Machine Learning:** What is Machine Learning, challenges, Applications, methods of Machine Learning, performance metrics, Data preprocessing, Data Loading, Understanding data, Pre-Processing unit
Unit-2: **Classification** – Decision Tree, K-nearest neighbor, logistic regression, support vector machine algorithm, naive Bayes algorithm, random forest algorithm
Unit -3: **Regression** - linear regression, Random Forest Regression **Clustering:** overview, k – means clustering, mean shift clustering, hierarchical clustering, DBSCAN clustering algorithm.
Unit – 4 **Introduction to neural networks:** Biological Neuron, ANN Perception, Network Topology (Feed forward network, Feedback Networks), Adjustments of Weights or Learning, Activation Functions, Training Algorithm, Gradient descent algorithms -Batch Gradient Descent, Stochastic Gradient Descent, Mini Batch gradient descent.

TEXT BOOK:

1. Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education,2013.

Websites:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.tutorialspoint.com/artificial_neural_network/index.htm

REFERENCE BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd edition, springer series in statistics, 2009.
2. Ethem Alpaydın, "Introduction to machine learning", second edition, MIT press, 2009.

JOURNALS/MAGAZINES:

1. Springer Journal of Machine Learning.
2. International Journal of Machine Learning and Computing.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Machine Learning

2.Coursera – Deep Learning

3. https://onlinecourses.nptel.ac.in/noc19_cs53/previe

SELF-LEARNING EXERCISES:

Reinforcement Learning: Introduction, Learning Task, Q Learning.

Website to be referred:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

2. https://www.tutorialspoint.com/artificial_neural_network/index.htm

Course Title	INFORMATION THEORY & CODING				Course Type		Theory	
Course Code	B20EQ0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: Information is the source of a communication system, whether it is analog or digital. Information theory is a mathematical approach to the study of coding of information along with the quantification, storage, and communication of information.

COURSE OBJECTIVE:

The objectives of this course are to:

1. Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
2. Study various source encoding algorithms.
3. Model discrete & continuous communication channels.
4. Study various error control coding algorithms.
5. Study various Channel Capacity
6. Study various types of Codes

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source	1 to 3	1
CO2	Represent the information using Shannon Encoding, Shannon Fano and Huffman codes	1 to 3, 5	2, 3
CO3	Model the continuous and discrete communication channels using input, output and joint probabilities	1 to 3	3
CO4	Determine a code word comprising of the check bits computed using Linear Block codes & convolutional codes	1 to 3, 5	1
CO5	Analyze various channel capacity of Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels	1 to 3, 5	2
CO6	Evaluate the matrix description of Linear Block Codes	1 to 3,5,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√		√	
CO3		√	√			
CO4			√	√		
CO5				√		
CO6					√	

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2										2		
CO2	2	2	3		3									3	2
CO3	2	2	3												2
CO4	2	3	2	3	2									3	
CO5	2	3	2		2									2	
CO6	2	3	2		2							2			2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY:

Contents
UNIT-1

Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources
UNIT-2
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI Encoding of the Source Output, Shannon's Encoding Algorithm Shannon Fano Encoding Algorithm, Huffman codes.
UNIT-3
Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, System Entropies, Mutual Information, Shannon theorem of Channel Capacity. **Channel Capacity of**: Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels
UNIT-4
Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Table lookup Decoding using Standard Array.

TEXT BOOKS:

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.

REFERENCE BOOKS:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016,
ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

JOURNALS/MAGAZINES

1. https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=information%20theory
2. https://www.elsevier.com/catalog/computer-science/computer-science-general/coding-and-information-theory

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/102/108102117/
2. https://www.coursera.org/learn/information-theory#syllabus

SELF-LEARNING EXERCISES:

Information theory is the mathematical treatment of the concept, parameters and rules governing the transmitions of messages through communication systems. Information theory as been most helpful in the design of more efficient telecommunication system.

Course Title	DIGITAL COMMUNICATION (PE-1)				Course Type		Theory	
Course Code	B20EQS501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: The course focuses on digital transmission and reception, signal space representations, spectral analysis of digitally modulated waveforms, design considerations for band limited channels, introductory concepts of information theory, and error correction coding. The course is intended for graduate/senior undergraduate level students. While the course is intended to serve as introduction to digital communications, the pre-requisites/co-requisites listed are absolutely necessary.

COURSE OBJECTIVE

The objectives of this course is to:

1. Demonstrate the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources.
2. Discuss the flow and processing of information from the source to various units at the transmitter side.
3. Illustrate the inverse operations at the receiver to facilitate the retrieval of transmitted information.
4. Describe various processing units of a digital communication system.
5. Solve multiplexing, multiple access, and spread spectrum concepts and techniques.
6. Analyze communications links and create system link budgets

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources	1 to 4	1
CO2	Analyze the flow and processing of information from the source to various units at the transmitter side.	1 to 4	1
CO3	Make use of the inverse operations at the receiver to facilitate the retrieval of transmitted information.	1 to 4, 6	1
CO4	Apply the different Channel coding methods for the given real world data.	1 to 4	1, 2
CO5	Solve multiplexing, multiple access, and spread spectrum concepts and techniques	3,4	3
CO6	Analyze communications links and create system link budgets	3,4	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2				√	√	
CO3			√	√		√
CO4			√		√	
CO5			√	√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									3		
CO2	3	2	2	2									3		
CO3	3	3	3	2		3							3		
CO4	3	3	1	2									3	3	
CO5	1	2	3	3											3
CO6	2	1	3	3	1										3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Information Theory: Information and entropy, conditional entropy and redundancy, Shannon Fano coding, Mutual Information, Information loss due to noise, source codings - Huffman Code, variable length coding, Source coding to Increase average Information per bit, Lossy source coding.
UNIT-2
Digital Modulation Techniques: Introduction, ASK,ASK Modulator, Coherent ASK Detector, Non-Coherent ASK Detector, FSK, Bandwidth and Frequency Spectrum of FSK. Non coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, BPSK, Coherent PSK Detection, QPSK, Differential PSK.
UNIT-3
Spread Spectrum Modulation Techniques: Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, and Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems
UNIT-4
Channel coding: Waveform Coding, Types of Error control, Structured Sequences, Matrix description of Linear Block Codes, Error detection and error Correction capabilities of linear block codes, Cyclic Codes, Algebraic structure, encoding.

TEXTEXT BOOKS:

1.Bernard Sklar, “Digital Communications - Fundamentals and Applications”, Pearson Education (Asia) Pvt. Ltd, 2nd Edition, 2014.
2. Herbert Taub. Donald L Schiling, Goutam Sana, “Principles of communication systems”, 3rd Edition, McGraw-Hill, 2008.
3. Sam Shanmugam, “Digital and Analog Communicator Systems”, John Wiley, 2005.

REFERENCE BOOKS:

1. John G. Proakis . Masoud Salehi, “Digital Communications”, 5th Edition, McGraw-Hill, 2008.
2. Simon Haykin, “Digital Communication”, John Wiley, 2005.
3. Ian A. Glover, Peter M. Grant, “Digital Communications”, Edition, Pearson Edu., 2008.
4. B.P. Lathi, “Communication Systems”, BS Publication, 2006.

JOURNALS/MAGAZINES:

1. Elsevier Journal Digital Communications and Networks.
2. IEEE Transactions on Communications.
3. Journal of Analog and Digital Communications.

SWAYAM/NPTEL/MOOCS:

1. https://www.nptel.ac.in/courses/108/102/108102096

2. https://www.coursera.org/.../digital-communication-fgL3y

SELF LEARNING EXERCISES:

Power spectra of digitally modulated signals, Performance comparison of digital modulation schemes, Signal space theory and various modulation schemes.

Course Title	System Software (PE-1)				Course Type		Theory	
Course Code	B20EJS502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

The course provides the architecture of SIC and SIC/XE machine to build the concepts of System Software, function of various system software: assemblers; loaders and linkers, and macro processors.

COURSE OBJECTIVE (S):

The objectives of the course are to:

1. Explain basics of system software and differentiate between system software and application software.
2. Describe assemblers design (pass1 and pass2) for the SIC and SIC/XE machine architecture.
3. Illustrate the working of the pass1 and pass2 algorithms of linkers and loaders.
4. Discuss functions and algorithms of macro-processor.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of different instruction formats and addressing modes of SIC and SIC/XE architectures for implementing arithmetic operations.	1 to6,12	1
CO2	Identify the suitable data structures required to develop various system softwares.	1 to5,12	1
CO3	Develop the programs for the pass1 and pass2 algorithms of linkers and loaders.	1 to5	1,2
CO4	Apply functions and algorithms of macro-processor to process a given macro definition.	1 to5	1,2
CO5	Explain basics of system software and differentiate between system software and application software	1 to5,12	1
CO6	Describe assemblers design (pass1andpass2) for the SIC and SIC/XE machine architecture.	1 to5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2				√	√	
CO3						√
CO4			√			
CO5				√	√	
CO6						√

COURSE ARTICULATION MATRIX:

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	1						1	3		
CO2	2	2	2	2	1							1	3		
CO3	2	2	1	1	1								3	3	
CO4	2	1	1	1	1								3	3	
CO5	2	2	2	2	1							1	3		
CO6	2	2	1	1	1								3	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Architecture of SIC; SIC\XE: Introduction: system software and machine architecture; Simplified Instructional Computer (SIC) – SIC; SIC/XE machine architecture; SIC and SIC/XE programming examples
UNIT-2
Assemblers: Basic assembler function; a simple SIC assembler; assembler algorithm and data structures; machine dependent assembler features - instruction formats; machine independent assembler features – literals symbol definition statements; expression; program blocks; control sections and programming linking
UNIT-3
Loaders and Linkers: Basic loader functions; design of an absolute loader; a simple bootstrap loader; machine-dependent loader features –relocation; program linking; algorithm and data structures for a linking loader; machine-independent loader features - automatic library search; loader options
UNIT-4
Macro Processor: Basic macro processor functions; macro definitions and expansion; macro processor algorithm and data structures; machine- independent macro processor features - concatenation of macro parameters; generation of unique labels; conditional macro expansion; keyword macro parameters

TEXT BOOKS:

1.Leland L Beck, “System Software”, 3rd Edition, Pearson Education, 2002.
2.Alfred V. Aho, “Compilers: Principles, Techniques and Tools”, Pearson, 2nd Edition, 2013.

REFERENCES BOOKS:

1. H. Dave,” Compilers: Principles and Practice”, Pearson, 1st Edition, 2012
2. Elsevier Journal of Systems and Software.
3. IEEE Transactions on Software Engineering

JOURNALS/MAGAZINES;

1. https://www.researchgate.net/publication/328956597_THE_IMPACT_OF_ACCOUNTING_SOFTWARE_ON_BUSINESS_PERFORMANCE
2. https://www.bioss.ac.uk/people/chris/app.pdf
3. 3 Elsevier Journal of Systems and Software.
4. IEEE Transactions on Software Engineering

SWAYAM/NPTEL/MOOCS:

1. https://www.coursera.org/learn/cloud-sys-software
2. https://www.ucdenver.edu/offices/office-of-information-technology/software/how-do-i-use/coursera

SELF LEARNING EXERCISES:

Design of a micro preprocessor, Peep whole optimizer and Compile and GO loader.

Course Title	Mobile Application Development (PE-1)				Course Type		Theory	
Course Code	B20EJS503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

This course introduces programming technologies, design and development tools related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using OS Software Development Kit (SDK).

COURSE OBJECTIVE (S):

1. Discuss mobile application models/architectures and patterns for development of a mobile software application
2. Demonstrate the installation of software and tools required for development of android applications.
3. Illustrate the use of fundamentals of android with graphics and animation APIs.
4. Describe an application with multimedia concepts of audio, video with entertainment services.

COURSE OUT COMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Android features to develop real world application.	1 to6,9,10	1
CO2	Design a suitable user interface and database for the given real world application.	1 to6,9,10,12	3
CO3	Choose the intrinsic controls required for the development of real world applications.	2 to5,9,10,11	1,2
CO4	Develop Android Services for multimedia, camera and location based activities.	1 to6,9,10,11	2,3
CO5	Discuss mobile application models/ architectures and patterns for development of a mobile software application	1 to6,9,10,12	3
CO6	Demonstrate the installation of software and tools required for development of android applications	1 to6,9,10,11	2,3

BLOOM'SLEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2					√	√
CO3				√		
CO4			√			√
CO5			√			
CO6		√	√			

COURSE ARTICULATION MATRIX:

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1				2	2			3		
CO2	2	3	2	3	2				3	2		2			3
CO3		2	3	1					3	1			3	3	
CO4	3	3	2	2	1				2	2				3	3
CO5	2	3	2	3	2				3	2		2			3
CO6	3	3	2	2	1				2	2				3	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT-1 **Introduction to mobile communication and computing**: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security, Smart phone operating systems and smart phones applications.
UNIT-2 **Fundamentals of Android Application Development:** Introduction to Android., The Android Jellybean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.
UNIT-3 **Layouts, Menus and Graphics in Android**: Menus: Options menu and app bar, Context menu and contextual action mode ,Popup menu, defining a Menu in XML, Creating an Options Menu, Changing menu items at runtime, Creating Contextual Menus, Creating Menu Groups, Adding Menu Items Based on an Intent, Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.
UNIT-4 **Creating the Activity, Working with views:** Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.

TEXT BOOKS:

1. Bill Phillips, Chris Stewart, and Kristin Marsican, "Android Programming: The Big Nerd Ranch Guide", Pearson Technology group,3rd Edition,2015.
2. Barry Burd, "Android Application Development All-in-One For Dummies", Wiley Publisher,2nd Edition, 2012.
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura,"Programming Android: Java Programming for the
4. New Generation of Mobile Devices", Oiley,2nd Edition,2012.

REFERENCE BOOKS:

1. Greg Nudelman, "Android Design Patterns: Interaction Design Solutions for Developer", Wiley, 2013.
2. Jason Tyler, "App Inventor for Android: Build Your Own Apps No Experience Required", Wiley,2011.
3. J.F. Dimarzio, "Android programming with Android studio", wrox,4th edition ,2017
4. 4.Maurice Sharp Erica Sadun Rod Strougo, "Learning iOS Development-A Hands-on Guide to the Fundamentals of iOS
5. Programming", Addison Wesley by Pearson Education, Inc.2014. .Wei-Meng Lee, "Beginning Swift Programming", Wiley India Pvt. Ltd.,2018.

JOURNALS/MAGAZINES:

1. https://www.researchgate.net/publication/303370028_A_Review_Paper_on_Cross_Platform_Mobile_Application_Development_IDE
2. igi-global.com/journal/international-journal-mobile-computing-multimedia/1102
3. https://www.researchgate.net/publication/339602524_Framework_for_Developing_Secure_Converged_Web_and_Mobile_Applications

SELF LEARNING EXERCISES: More Recent Applications: Multimedia;2D graphics ; networking support in Android, Introduction to IoS, App. Development

Course Title	Human Computer Interaction (PE-1)				Course Type		Theory	
Course Code	B20EJS504	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

This course presents the foundations of Human Computer Interaction (HCI). The contents are structured into phases comprising: Basic definitions and motivations of HCI, interaction paradigms, design principles and models, User-centred design methods comprising user studies, design approaches for interfaces and interaction, evaluation methods and techniques for data analysis, Research frontiers of HCI, including accessibility, universal design, and pervasive computing (ubiquitous, mobile and wearable computing).

COURSE OBJECTIVE (S):

The overall objective of the Course is as follows:

3. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
4. Describe typical human-computer interaction (HCI) models and styles, as well as various HCI paradigms.
2. Demonstrate the use of an interactive design process and universal design principles in designing HCI systems.
3. Illustrate the use of different evaluation methods.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the suitable positioning and pointing device to be used to work with the given application.	1 to5	1
CO2	Develop the user interface by Selecting an effective style for the given real world applications.	1 to5	2
CO3	Make use of different UI design rules to develop a user interface for a real-world application.	1 to5	3
CO4	Compare the different evaluation techniques used to measure the quality of User Interface.	1 to5	1
CO5	Demonstrate the use of an interactive design process and universal design principles in designing HCI systems	1 to5	2
CO6	Illustrate the use of different evaluation methods	1 to5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√	√		√
CO3			√			
CO4				√	√	
CO5			√	√		√
CO6			√			

COURSE ARTICULATION MATRIX:

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2								3		
CO2	3	2	1	1	2									3	
CO3	3	2	2	3	1								3		3
CO4	2	3	3	2	2								3		
CO5	3	2	1	1	2									3	
CO6	3	2	2	3	1								3		3

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Human and the Computer: Human: Input-output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks.
UNIT-2
The interaction and Paradigms: Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction. **Paradigms:** Paradigms for interaction. Interaction design basics: The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.
UNIT-3
HCI in the software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping. Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Universal designs.
UNIT-4
Evaluation techniques: Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method.

TEXT BOOKS:

1. Dix, Janet Finlay, Gregory Abowd & Russell Beale, “Human-Computer Interaction”, 3rd Edition. Prentice Hall, 2004.
2. Julie A. Jacko, “Human-Computer Interaction Handbook”, 3rd Edition, CRC Press, 2012.
3. Ben Shneiderman, Catherine Plaisant, “Designing the User Interface”, 6th Edition, Addison Wesley, 2017.

REFERENCE BOOKS:

1. 1.Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser,” Research Methods in Human- Computer Interaction”, Wiley, Second edition, 2010

JOURNALS/MAGAZINES:

1. ACM, International Journal of Human-Computer Studies, 2003.
2. IEEE, Transactions on Human-Machine Systems, 2014
3. Elsevier, International Journal of Human-Computer Studies. 2005.

SELF LEARNING EXERCISES:

Designing user support systems, Ubiquitous computing applications research, Hypertext, multimedia and the World Wide Web.

Course Title	DATA MINING (PE-I)				Course Type		Theory	
Course Code	B20EQS505	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

This course will cover the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision making, with an emphasis on statistical approaches that can be generally applied to arbitrary text data in any natural language with no or minimum human effort. Detailed analysis of text data requires understanding of natural language text, which is known to be a difficult task for computers. This course focuses on extracting knowledge from the web by applying Machine Learning techniques for classification and clustering of hypertext documents. Basic approaches from the area of Information Retrieval and text analysis are also discussed. The students use recent Machine Learning and Data Mining software to implement practical applications for web document retrieval, classification and clustering.

COURSE OBJECTIVES

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Describe the classification algorithms for data categorization
4. Illustrate the clustering algorithms for grouping datasets
5. Demonstrate the appropriate data mining techniques for decision making

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of data mining techniques, data types, identify the similarity and dissimilarity between the datasets and analyze the data sets using the association rules and algorithms	1,2,4,6,11,12	1,2
CO2	Characterize and discriminate data sets with classification methods	1-7	2
CO3	Employ the clustering methods in real life problems	1-7	2,3
CO4	Apply the knowledge for data mining applications	1-7,12	2,3
CO5	Learn new tools and technologies in the Data Mining and apply for suitable application development.	12	2,3
CO6	Develop solutions in the Data Mining to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√	√		
CO4			√		√	
CO5		√	√	√		
CO6			√	√	√	

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1		1					2	1	2	3	
CO2	3	3	2	2	3	2	1						3	3	
CO3	3	2	3	2	3	2	3							3	3
CO4	3	2	3	2	3	1	1					2		3	3
CO5												3			
CO6					3				3	3					

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction: What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization.
UNIT-2
Association Analysis: Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP GROWTH Algorithm, Evaluation of Association Patterns .
UNIT-3
Classification: Basics, General approach to solve classification problem, Decision Trees, Evaluating the performance of a Classifier, Rule Based Classifiers, Nearest Neighbour Classifiers, Naïve Bayes Classifier
UNIT-4
Clustering: overview, K-means, agglomerative hierarchical clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters and Clustering Algorithms, Prototype Based Clustering.

TEXT BOOKS:

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education ,2007.
2. JiaweiHan and Micheline Kamber, "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.

REFERENCE BOOKS:

1. K.P.Soman,Shyam Diwakar and V.Ajay,"In sight in to Data mining Theory and Practice" ,Easter Economy Edition, Prentice Hall of India,2006.
2. G.K.Gupta, "Introduction to Data Mining with Case Studies" ,Easter Economy Edition, Prentice Hall of India,2006.

JOURNALS/MAGAZINES:

1. Data Mining and Knowledge Science – Springer.
2. Inter science, The International Journal of DataMining, Modelling and Management-
3. IEEE, IEEE Transactions on Knowledge and Data Engineering.

SWAYAM/NPTEL/MOOCS:

1. https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing
2. https://www.coursera.org/learn/text-mining
3. https://www.ibm.com/cloud/learn/text-mining

SELF LEARNING EXERCISES:

1. https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing
2. https://www.coursera.org/learn/text-mining
3. https://www.ibm.com/cloud/learn/text-mining

Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE (OE-1)				Course Type			
Course Code	B20CIO501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: This course introduces the basics of Artificial Intelligence (AI), AI problems and search strategies. The students can explore knowledge representation issues and methods. This course provides planning methods, for problem solving and controlling the knowledge and also demonstrates various learning methods for constructing knowledge and taking decisions.

COURSE OBJECTIVE:

The objectives of this course are to:

1. Discuss the basics of Artificial Intelligence (AI).
2. Illustrate knowledge representation issues and methods
3. Explain planning methods/algorithms in problem solving
4. Describe the concepts of intelligent agent in a specific environment.
5. Learn new tools and technologies in the artificial intelligence development and apply for suitable solutions for application development
6. Analyse solutions using AI to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation

COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve AI problems using AI search strategies and production system.	1 to 6	2
CO2	Represent knowledge using logic and apply reasoning methods for the given real world problem.	1 to 6	1
CO3	Make use of planning and probability to solve uncertainty problems.	1 to 6	1
CO4	Develop an intelligent agent in a specific environmentto solve real world problems.	1 to 6	1,2
CO5	Learn new tools and technologies in the artificial intelligence development and apply for suitable solutions for application development	12	1
CO6	Analyse solutions using AI to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	5,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√		√		√
CO2			√		√	√
CO3		√		√	√	
CO4	√	√	√	√	√	√
CO5		√				
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	3								3	
CO2	3	3	3	2	3	3							3		
CO3	3	2	3	3	3	3							3		
CO4	3	2	2	2	2	3								3	3
CO5	2	2	3	2	3	2							3		
CO6	2	3	2	3	2	3							3		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
Unit – 1
Problems and search: What is AI, AI Problems; AI Techniques; Problem Space and Problem Search techniques; Defining the problem as a state space search, production systems; Problem characteristics, production system characteristics, Issues in the design of search programs; Heuristic search techniques, generate-and-test; Hill climbing, BFS, DFS; Problem reduction; Constraint satisfaction
Unit -2
Knowledge Representation: Knowledge representation Issues, representations and mappings; Approaches to knowledge representation; Issues in knowledge representation; Using Predicate logic: Representing simple facts in logic; Representing Instance and ISA relationships; Computable functions and predicates; Representing Knowledge using Rules; Procedural versus declarative knowledge; Resolution Forward versus backward reasoning; Matching
Unit – 3
Planning: A simple planning agent; Representations for planning; A partial-order planning example; A partial-order planning algorithm; Planning with partially Instantiated operators; Knowledge Engineering for planning; Uncertainty: Sources of Uncertainty; Probability Theory, Issues with Probability; Advantages & Disadvantages of Bayesian Network
Unit – 4
Intelligent Agents: Introduction, How Agent should Act, Structure of Intelligent Agents, Agents and environments, Rationality, PEAS (Performance measure, Environment, Actuators, Sensors), Environment types, Agent types. Environments.

TEXT BOOKS:

1. Russell & Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice-Hall, 2010.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd edition, TataMcgraw Hill, 2009.

REFERENCE BOOKS:

1. Nils J.Nilsson, "Principles of Artificial Intelligence", Elsevier, 1980.
2. Krishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka, "Artificial Neural Networks", Penram International Publishing, 1997.
3. B.Yegananarayana, "Artificial Neural Networks", PHI, 2001.

JOURNALS/MAGAZINES

1. ACM, ACM transaction on Multi-Agent System.
2. IEEE, IEEE transaction for computational Intelligence.
3. Springer, Springer transaction for security based intelligent systems.

SWAYAM/NPTEL/MOOCs:

1. https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in- 2020-ec77ad13bdc1
2. https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in- 2020-ec77ad13bdc1
3. https://javarevisited.blogspot.com/2020/08/top-10-coursera-courses-and-certification-for-artificial- intelligence-and-machine-learning.html#axzz6jQ05pXOG

SELF-LEARNING EXERCISES:

1. Prolog programming language for artificial intelligence.
2. Multi-Agent Systems and Agent Communication for distributed problem solving which is performed by agents working together towards a solution of a common problem.

Course Title	OOPS USING C++ (OE-1)	Course Type	Theory

Course Code	B20CIO502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course introduces the basic concepts of object oriented programming. Familiarizes with object creation and accessing members of object. OOPs concepts such as data abstraction, information hiding (Encapsulation), overloading operations, inheritance mechanisms, virtual functions, friend functions and are discussed. FileI/O operations, Templates and exception handling mechanisms are also introduce

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the basic concepts of objects and classes for a real world application.
2. Illustrate the use of operator overloading/function overloading for given applications.
3. Demonstrate the use of inheritance in real world applications.
4. Describe I/O streams and Templates and Exception Handling
5. Learn new tools and technologies in the concepts of object oriented programming and apply for suitable solutions for application development.
6. Develop solutions using concepts of object oriented programming to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic concepts of objects and classes for a real world application	2,3,7,11	1,2
CO2	Develop applications by implementing operator overloading and function overloading.	2,3,4,5	2,3
CO3	Make use Inheritance feature of OOPs to develop a real world application	1-4,8,9,11	2
CO4	Build the real world application using exception handling and templates	1-4,11,12	2
CO5	Learn new tools and technologies in the concepts of object oriented programming and apply for suitable solutions for application development.	5	1
CO6	Develop solutions using concepts of object oriented programming to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	5,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2	√	√				
CO3		√	√			
CO4		√	√	√		√
CO5	√	√	√			
CO6	√	√				√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	
CO4	1	2	3	1							1	1		2	
CO4	1												1	2	
CO4			2												1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT-1
Introduction: Introduction to object oriented concepts: Encapsulation, Abstraction, Inheritance, Polymorphism, Overview of OOP, Introduction to object oriented modelling, Introduction to variables in C++, I/O operators, Function overloading, Inline function, Recursive function. **Classes & Objects:** Introduction to Classes, Member Functions and Member data, Constructors and Destructors, Static Class members.
UNIT-2
Operator overloading: Introduction to Objects, Array of Objects, Dynamic Objects, Pointers to objects, Friend Function, Access specifiers. The scope resolution operator, Generic functions and classes, Operator overloading using Friend function: Unary operator '+' & binary operator, Copy constructor.
UNIT-3
Inheritance: Base Class, Inheritance and Protected members, inheriting multiple base classes, Constructors, Destructors and Inheritance, Virtual base classes. Virtual functions and Polymorphism: Virtual functions, pure virtual functions, Early and late binding.
UNIT-4
Templates and Exception handling: Template Functions, Template Classes, Fundamentals of Exception handling, handling derived class exceptions.

TEXT BOOKS:

1. HerbertSchildt, "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003.
2. SanleyB.Lippmann, JoseeLajore, "C++ Primer", 4th Edition, Pearson Education, 2005.

REFERENCE BOOKS:

1. Paul J Deitel, Harvey M Deitel, "C++ for Programmers", Pearson Education, 2009.
2. K R Venugopal, RajkumarBuyya, T Ravi Shankar, "Mastering C++", Tata McGraw Hill, l999.

JOURNALS/MAGAZINES:

1. ACM, ACM Transactions on Programming Languages and Systems(TOPLAS).
2. ACM Journal on Object-Oriented Programming

SWAYAM/NPTEL/MOOCS:

1. https://www.coursera.org/specializations/object-oriented-programming
2. https://www.coursera.org/lecture/writing-running-fixing-code/introduction-to-the-programming-environment-sXizU
3. https://www.coursera.org/learn/object-oriented-design

SELF LEARNING EXERCISES:

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, <fstream> and File classes.

Course Title	WEB TECHNOLOGY (OE-1)				Course Type		Theory	
Course Code	B20CIO503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course covers features of HTML 5 and CSS 3, controls and web services of ASP.Net and database access with MYSQL, basics of AngularJS, basics of AJAX and JQuery AJAX library, basics of Ruby, controls and RESTFul web services. These concepts are used in the development of Client-Server technology.

COURSE OBJECTIVE

The objectives of this course are to:

1. Understand the various steps in designing a creative and dynamic website.
2. Describe the hierarchy of objects in HTML and XML.
3. Design dynamic and interactive web pages by embedding Java Script code in HTML.
4. Illustrate the advantages and use of different types of CSS.
5. Examine the HTML. Know how to use Dynamic HTML.
6. Familiarize server side scripting language like Perl &PHP.

COURSE OUTCOMES (COs)

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2
CO4	Apply JavaScript to develop the dynamic web pages and use server side scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Learn new tools and technologies in web technology and apply for suitable solutions for application development.	5	2
CO6	Develop solutions in web technology the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√				
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	
CO4	1	2	3	1							1	1		2	1
CO5	1	2	3	2	3	2							1		1
CO6	1	2	3	3	2	2								1	2

COURSE CONTENT
THEORY

Contents
UNIT-1
Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration - Namespaces JavaScript and XML
UNIT-2
Style Sheets: Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution. Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors.
UNIT-3
Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; Cookies. Database access with Perl and MySQL
UNIT-4
Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables.

TEXT BOOKS:

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education.
2. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006. 2007.

REFERENCE BOOKS:

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
2. Marty Hall and Larry Brown, “Core Web Programming” Second Edition, Volume I and II,
3. Pearson Education, 2001.
4. Bates, “Developing Web Applications”, Wiley, 2006.

JOURNALS/MAGAZINES:

1. International Journal of Web Technology- ISSN:2278-2389
2. International Journal of Web & Semantic Technology (IJWesT)
3. ELSEVIER Journals within "Internet and Web Technology”

SWAYAM/NPTEL/MOOCS:

1. https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
2. https://nptel.ac.in/courses/106/105/106105084/

SELF LEARNING EXERCISES:

The student is expected to study more about the following topics: Rails and Angular JS.

Course Title	**Web Technologies and Applications Lab**				Course Type		Theory	
Course Code	B20EJ0504	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

COURSE OVERVIEW:

The basics of Web application tools such as HTML, XHTML and CSS are introduced. The course also provides knowledge about advanced research topics such as XML, Perland PHP.

COURSE OBJECTIVE(S):

The objectives of this course are to:

Understand the various steps in designing a creative and dynamic website.

Describe the hierarchy of objects in HTML and XML.

Design dynamic and interactive web pages by embedding Java Script code in HTML.

Illustrate the advantages and use of different types of CSS.

Examine the HTML. Know how to use Dynamic HTML.

Familiarize server side scripting language like Perl &PHP.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user- friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2,3

CO4	Apply Java Script to develop the dynamic web pages and use server side Scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Examine the HTML .Know how to use Dynamic HTML.	2,3,4,5	2,3
CO6	Familiarize server side scripting language like Perl & PHP.	2-5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√	√	√	√	
CO6		√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	1
CO4	1	2	3	1							1	1		2	1
CO5		2	2	3	1									2	2
CO6		1	2	3	1								1	2	

Note:1-Low,2-Medium,3-High

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	In today's digital world, information dissemination through printed documents consumes lot of time. To overcome this drawback, it is better to adopt digital technology for information dissemination, like e-journals, e-books, e-advertisements, etc. Information dissemination through Internet in the form of web content is essential and convenient option. Design and develop static web pages for an online Book store. The pages should resemble like www.amazon.com The website should consist of. Home page, Registration & Login, User profile page, Books	HTML, CSS, PhP, JS, Java	Basic Programming
2.	Internet or online services works on clients and server model. A client is a web browser through which users make requests, which contain input required, for service from the server to perform tasks. Server is a program running on a dedicated computer. Performance of any service or server depends on its throughput. Server throughput deteriorates when users send more and more invalid requests for service and thus results in wastage of server resources that are very precious. As a solution to this problem design a web page that takes student details such as Name, branch, Semester, University, date of admission, mobile number, email id and check for validity or correctness of the input data by writing a JavaScript to validate these fields.	HTML, CSS, PhP, JS, Java	Basic Programming
3.	Clients interact with servers by sending service requests that contain input required to complete the requested task or service. Input required for requested service may be collected through a web page, that acts as an interface between users and the server, in the form of text fields, text areas, radio buttons, push buttons and so on. Hence it is better to instruct or help clients to input correct data through web page by displaying appropriate error messages or alerts as and when users supply wrong input using event handlers. To demonstrate this task, design and develop a web page using JavaScript, XHTML that collects the SRN (Valid format is: Any letter followed by two digits, followed by two letters then followed by three digits). Include event	HTML, CSS, PhP, JS, Java	Basic Programming
4.	Dynamic web content is the information that is retrieved from one or more web servers depending upon what information client have requested for, and composed in response to users' requests. Advanced web technologies play a vital role in storage, processing and retrieval of dynamic web content from web servers. Hence it is important to use advanced web technologies such as XML to improve the efficiency in data retrieval. Create	HTML, CSS, PhP, JS, Java	Basic Programming

5.	. Information technology has become part and parcel of humanity to such an extent that people can shop anything online, from anywhere, at any time using an electronic device that has access to Internet. This has brought in the concept of virtual stores which provide products at less cost. To improve sales it is mandatory to organize items catalog based on item name, item price, and manufacturer so on. For such online shopping sites, look and feel is an obvious requirement which can	HTML, CSS, PhP, JS, Java	Basic Programming
6.	In any business organization, employees keep traveling across different geographical locations and at the same time they want to be connected to their organization's computing resources such as email server, database server, file server, etc. to retrieve information such as sales details, assigning tasks to employees, and upload inspection site details, so on. Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition and publisher and store information submitted through web page in MySQL database. Design another	HTML, CSS, PhP, JS, Java	Basic Programming
7.	Using computers without graphical user interfaces require the knowledge about syntax of computer commands and programming languages, also this makes users to feel that the use of computers is difficult and cumbersome. This impression of users on computers can be changed by providing good and easy-to-use graphical user interfaces which play vital role in use of computer applications or software without worrying about syntax of programming languages or computer commands. In fact computer software with good and easy-to-use graphical user interfaces will have large number of users. a) Design HTML page that takes UNIX command as input in a text field and submit it to a Perl program that executes given command and display the	HTML, CSS, PhP, JS, Java	Basic Programming
8.	Databases are the storage systems used by most of the business and information technology enterprises as back end. When users generate data using GUI, for ex. personal information, data are sent to back end database for storage and also users can retrieve this data as and when required from the back end (database) to the front GUI. In the real world there are several databases such as Oracle, DB2, MySQL, SQL Server, MS-Access, DBMongo, etc. To illustrate the process of generating data from the front end and store it on back end database then retrieve the available data from the back end database, write a Perl program to read personal information of a person such as first name, last name, age, permanent address and pin code entered by the user into a	HTML, CSS, PhP, JS, Java	Basic Programming
9.	Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.	HTML, CSS, PhP, JS, Java	Basic Programming

Course Title	**MACHINE LEARNING Lab**				Course Type		Theory	
Course Code	B20CI0505	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

COURSE OVERVIEW:

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

COURSE OBJECTIVES:

The objectives of this course are to:

Explain machine learning and problems relevant to machine learning.

Discuss the fundamentals of Decision trees learning and its issues

Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.

Describe statistical analysis of machine learning techniques.

COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design the learning system to provide the solution for the given problem.	1 to 5	1,2
CO2	Apply Decision Tree technique for Classification problem	1 to 5	
CO3	Develop Recognition or Prediction systems using Neural Network / Bayesian Model	1 to 5	2,3

CO4	Solve the problem by hypothesis testing using probability and statistics.	1 to 5	2,3
CO5	Understandability of technological enhancement via improvising versions of machine learning knowledge transfer learning and deep learning	10,12	2,3
CO6	Analysing the influence of extended machine learning terminologies vis lifelong learning	11,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√		√		
CO6				√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3
CO4	3	2	2	2	2								3	3	3
CO5	3	2	2	2	2					2		3		2	2

CO6	3	3	2	2	2						3	3		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT LAB:

1	**Decision Tree Classifier** Implement and demonstrate a Decision Tree Classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given medical diagnosis dataset.
2	**Feature extraction using Principal Component Analysis (PCA)** Implement and demonstrate the Principal Component Analysis algorithm for dimensionality reduction for any dataset.
3	**K nearest neighbour (KNN)** Implement and demonstrate the k-Nearest Neighbour algorithm (k-NN) to classify the iris data set. Display the Confusion matrix and classification report. Also, try the same algorithm of the social networks dataset to predict a customer can purchase an item or not.
4	**Support Vector Machine (SVM)** Implement and demonstrate a Support vector machine classifier to classify the instances of any dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
5	Short Title: **Regression** Implement and demonstrate linear regression and logistic regression algorithms for any given dataset(s). Visualize the results using graphs. (Salary prediction, Price Prediction)
6	**Random Forest (RF)** Implement and demonstrate a Random Forest classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
7	**K-Means Clustering** Implement and demonstrate the k-means clustering algorithms. Visualize the results using graphs.
8	**Hierarchical clustering** Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
9	**DBSCAN clustering** Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
10	Short Title: **Artificial Neural Networks (ANN)** Implement and demonstrate the two hidden layer multilayer perceptron neural network to any given dataset for classification. Apply two different optimizers or activation functions and compare the results.

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education, 2013.

Websites:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.tutorialspoint.com/artificial_neural_network/index.htm

RECOMMENDED LEARNING RESOURCES (REFERENCE BOOKS):

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd edition, springer series in statistics.
2. Ethem Alpaydın, "Introduction to machine learning", second edition, MIT press.

JOURNALS/MAGAZINES:

1. Springer Journal of Machine Learning.
2. International Journal of Machine Learning and Computing.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Machine Learning
2. Coursera – Deep Learning
3. https://onlinecourses.nptel.ac.in/noc19_cs53/preview

SELF-LEARNING EXERCISES:

Reinforcement Learning: Introduction, Learning Task, Q Learning

Course Title	**COMPUTER NETWORKS Lab**				Course Type		Theory	
Course Code	B20CI0506	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

COURSE OVERVIEW

The main emphasis of this course is on the organization and management of local area networks (LANs). The course description include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and about Open Systems Interconnection (OSI) communication model with TCP/IP protocol; This course provides knowledge of error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login Protocols.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication.

2. Discuss the MAC protocols, error detection & correction strategies for data transmission over the networking devices.

3. Describe the standards for data communication with routing protocols.

4. Illustrate the client server communication using TCP or UDP protocols and other application level protocols

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1 to 6, 12	2
CO2	Discover the good network design with simplicity, scalability, performance and the end-to-end principle	1 to 6, 12	2

CO3	Appraise the working principles of Internet.	1 to 6, 12	3
CO4	Compile the effectiveness of existing or similar network protocols.	1 to 6, 12	3
CO5	Design a component or a product applying all the relevant standards and with realistic constraints	5,6,9,10	2
CO6	Compare various congestion control mechanisms and identify appropriate Transport layer protocol for real time applications	5,6,9,10	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			√			
CO2			√	√		
CO3			√	√	√	
CO4			√	√	√	√
CO5			√			
CO6						√

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1						1			
CO2	3	3	3	3	2	2						1		3	
CO3	3	3	3	3		1						2			3
CO4	3	3	3	2	2	1						1			3
CO5					2	3			2	3				3	
CO6					2	3									3

Note: 1-Low, 2-Medium, 3-High

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part - A			

1	a) Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	RJ-45 connector, IO Connector, Crimping Tool, Twisted pair Cable, Cable Tester.	Cable Crimping, Standard Cabling and Cross Cabling, IO connector crimping and testing the crimped cable using a cable tester can be done successfully
	b) Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and Wireless LAN.	NIC, Adapter	Installation and configuration of Wired and Wireless (remotely) NIC and transfer files between systems in LAN and Wireless LAN between two systems in a LAN can be done successfully.
	c) Install and configure Network Devices: HUB, Switch and Routers.	HUB, Switch, Router and configuration software.	Gain the knowledge on configuring the different connecting devices
	d) Connect the computers in Local Area Network.	Computer Systems with connecting media.	Interconnection and building a simple LAN
2	Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.	Computer Systems with connecting media.	Configuration of peer to peer network communication
	Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	Connected Computer Systems.	Configure Internet connection
	Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network	Connected Computer Systems with printer.	File transfer between systems in LAN using FTP Configuration.
	Study of basic network command and Network configuration commands	Command Prompt	Network configuration
3	In information theory and coding theory with applications in computer science and telecommunication, error detection and correction or error control are techniques that enable reliable delivery of digital data over unreliable communication channels. Many communication channels are subject to channel noise, and thus errors may be introduced during transmission from the source to a receiver. Error detection techniques allow detecting such errors, while	CRC Hamming Code	Error detection and control in data transmission.

	error correction enables reconstruction of the original data in many cases. Write a Program for Implementation of any one mechanism for Error Detection / Error Correction Techniques.		
4	A routing algorithm is a procedure that lays down the route or path to transfer data packets from source to the destination. They help in directing Internet traffic efficiently. ... Routing algorithm mathematically computes the best path, i.e. "least – cost path" that the packet can be routed through Write a Program for Implementation of any routing algorithms.	Distance vector & Link state routing	Routing in networks before the communication begins.
Part B: Mini Project 1: Design of Corporate Network			
1	Configuring a Switched network and Study of VLAN's and assigning a PC based on the VLAN.	Windows/Linux OS, Packet Tracer	Switch and VLAN Configuration.
2	Implementing an IP Addressing Scheme Configuring WEP on a Wireless Router. Interpreting Ping and Traceroute Output	Windows/Linux OS, Packet Tracer	Router configuration and connectivity checking.
3	Configuring Static Routing. Configuring Dynamic Routing protocols RIP, OSPF.	Windows/Linux OS, Packet Tracer	Static and Dynamic Routing over a network
4	Examining Network Address Translation (NAT). Configuring a Cisco Router as a DHCP Server	Windows/Linux OS, Packet Tracer	Configuration and working of NAT with setup of DHCP server.
Part C: Mini Project 2: Performance Analysis of TCP and UDP applications over the different Topologies of network			
1	Consider Six nodes and demonstrate the different ways of connecting them in topology methods. Also specify the different transmission media with specific channel specifications.	Python, NS3, Ubuntu.	Create an interface between the devices using different topologies.
2	Configure the IP address of the nodes in the specified network. Achieve the port specifications for different applications. Apply and Demonstrate the TFTP on the	Python, NS3, Ubuntu.	Analyze the performance using UDP based applications

	specified network using UDP. Observe the trace results.		
3	Apply and Demonstrate the FTP and TELNET on the specified network using TCP. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the performance using TCP based applications
4	Apply and Demonstrate the Congestion and Error Controlling mechanism in the specified networks. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the congestion and error controlling in TCP based applications

Course Title	**TECHNICAL DOCUMENTATION**				**Course Type**		**Theory**	
Course Code	B20CI0503	**Credits**	**1**		**Class**		**V semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**1**	**1**	**13**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The goal of this course is to prepare engineering students with the individual and collaborative technical writing, presentation, and research skills necessary to be effective technical communicators in academic and professional environments

COURSE OBJECTIVE:

The objectives of this course are:

1. To emphasize on how to prepare a technical document or a research paper for publication in a journal.
2. To teaches students a step-by-step procedure through several examples, how to plan, organize, draft, develop and prepare a document for presentation.
3. To use grammar, a precise method of preparing a document simply, clearly, and concisely
4. To organize the material in a sequential manner for writing the thesis or paper
5. To address the issues related to identifying authors and their writings through their names and affiliations, and abstracts of the work, etc.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the importance of technical writing and communicate effectively through a proper structure.	1 to 4, 8, 9, 12	1
CO2	Provide technical information and knowledge in practical documents in different styles.	1 to 3, 5,9,12	1
CO3	Practice the unique qualities of professional writing style, including sentence conciseness, readability, clarity and accuracy	1 to 5, 9, 12	2
CO4	Recognize the importance of editing and edit without bias	1,4,5,9,12	1
CO5	Learn new tools and technologies in technical document and apply for suitable solutions for application development.	12	2
CO6	Develop solutions in technical document to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4						√
CO5		√				
CO6		√				√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2				2	2			2	2		
CO2	2	2			3				3			3	3		
CO3	1	2	1	2	3				2			2		3	
CO4	1	2	3	1	2				3			2	2		
CO5	2	3	2	2	3	3							2	3	
CO6	2	3	3	3	2	2							3	2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Technical Writing Structure: The Importance of Information Structures: Descriptions versus Instructions; Understanding Role of Description: Structure of object and Mechanism Description, Structure of Process Description;
UNIT-2
Technical Writing Style: Concise Communication: Common Errors while constructing sentences; Clarity and Precision: Guidelines to clear and specific writing; American and British English; Style Manual.
UNIT-3

Technical documentation Editing: Meaning; Types of Editing; Technical letters writing, article writing, report writing, thesis writing, slide preparation, project proposal writing, and introduction to tools for documentation like Latex in Linux and Latex in windows.
UNIT-4
Technical documentation Ethics: What is Legal & Ethical? Ethical Issues in Technical documentation; copyright, Plagiarism

TEXTBOOKS:

1. BN Basu, Technical Writing, Prentice Hall India Learning Private Limited, 2009
2. SD Sharma, Textbook of Scientific and Technical Communication Writing for Engineers and Professionals, Ivy Publishing House, 2008

REFERENCE BOOKS:

1. P. Oliver, Writing Your Thesis,New Delhi:Vistaar Publications, 2004.
2. F. Mittelbach and M. Goossens,The LATEX Companion, 2nd. ed. Addison Wesley, 2004

Course Title	SOFTWARE TESTING				Course Type		Integrated	
Course Code	B20EJ0503	Credits	2		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	1	1	Theory	Practical	CIE	SEE
	Tutorial	0	0	0				
	Total	**2**	**2**	**2**	**13**	**13**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: This course examines fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test case generation, test coverage, regression testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization

COURSE OBJECTIVE

1. Discuss fundamental concepts in software testing.
2. Illustrate the use of different software testing methods.
3. Demonstrate the use of Selenium IDE to develop applications.
4. Discuss the use of locators in developing real world applications.
5. Apply the principles, tools, and practices of IT project management.
6. Estimate time, processes, and resources effectively by prioritizing competing demands.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the fundamental concepts in software testing.	1 to 5, 9, 10	1
CO2	Analyse the performance of testing methods on the given real world applications.	1 to 5	1
CO3	Develop an application using Software Testing IDE.	1 to 5 , 10 ,12	2, 3
CO4	Make use of locators in developing real world applications.	1 to 5	1
CO5	Apply the principles, tools, and practices of IT project management.	1, 3 ad 7	1
CO6	Estimate time, processes, and resources effectively by prioritizing competing demands.	1, 3 ad 7	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√		√
CO3			√			√
CO4			√			
CO5			√			
CO6					√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1				1	1			3		
CO2	3	3	2	2	1								3		
CO3	3	2	2	1	1					1		1		3	3
CO4	3	3	3	3	3	1							3		
CO5	3		2				3								
CO6	3		3				3								

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction: Software Testing Principles Need for testing, Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing, **Examples:**

Generalized pseudocode, The triangle problem, The NextDate function, The commission problem. Introduction to Automated testing tools (open source and commercial)
UNIT-2
FunctionalTesting: Boundary value analysis, Robustness testing, Equivalence Class Testing, Decision table method, **Examples:** The triangleproblem, **Structural Testing:** Path Testing: DD-Paths, Test Coverage Metrics, Basis path Testing; Dataflow Testing: define/Use Testing, Slice Based Testing
UNIT-3
Getting Started with Selenium IDE: Important preliminary points, What is Selenium IDE, installing Selenium IDE, Selenium IDE, Rules for automation, Recording your first test with Selenium IDE Updating a test to assert items are on the page,updating a test to verify items on the page adding Selenium IDE comments, Multiplying windows, Working with multiple windows.
UNIT-4
Locators: Locating elements by ID, Finding IDs of elements on the page with Fire bug, finding elements by ID, Moving elements on the page, finding elements by name, Adding filters to the name, finding elements by link text. Overview of Selenium Web Driver, History of Selenium Architecture, Web Driver API, Web DriverSPI.

PRACTICE

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Write programs in "C" language to demonstrate the working of the following: a.Constructs: i) do…while ii) while….do iii) if…else iv) switch v) for	C	Generate Test case with input, Expected output, Actual Output and remarks.
2.	A program written in "C" language for Matrix Multiplication fails or Introspect the causes for its failure and write down the possible reasons for its failure.	C	Generate Test case with input, Expected output, Actual Output and remarks.
3.	Take any system (e.g. ATM System) and study its system specifications and report the various bugs	C	Generate Test case with input, Expected output, Actual Output and remarks.
4.	Take any system (e.g. ATM System) and study its system specifications and report the various bugs.	Word	Generate Test case with input, Expected output, Actual Output and remarks.
5.	Create a test plan document for any application (eg. Library Management System)	Word	Generate Test case with input, Expected output, Actual Output and remarks.
6.	Study of any testing tool (eg., Win runner)	Win runner	Generate Test case with input, Expected output, Actual Output
7.	Study of any web testing tool(eg., Selenium)	Selenium	Generate Test case with input, Expected output, Actual Output and remarks.
8.	Study of any bug tracking tool (eg., Bugzilla, bugbit)	Bugzilla, bugbit	Generate Test case with input, Expected output, Actual Output and remarks.
9.	Study of any test management tool (eg., Test Director)	Test Director	Generate Test case with input, Expected output, Actual Output and remarks.

10.	Study of any open source-testing tool(eg., Test Link)	Test Link	Generate Test case with input, Expected output, Actual Output and remarks.

TEXT BOOKS:

1. P.C. Jorgensen, "Software Testing A Craftman's Approach", CRC Press, Auerbach Publications2013.
2. David Burns, Selenium 2 Testing Tools Beginner's Guide.

REFERENCE BOOKS:

1. Glenford J. Myers, "The Art of Software Testing", John Wiley & Sons 1979
2. Boris Beizer, "Black-BoxTesting: Techniques for Functional Testing of Software and Systems", John Wiley & Sons 1995.
3. William E. Perry," Effective Methods for Software Testing (2nd Edition)" ,John Wiley& Sons 2000

JOURNALS/MAGAZINES:

1. Journal of Software Engineering and Research Engineering.
2. International Journal of Software Engineering, Technology and Applications

SWAYAM/NPTEL/MOOCS:

1. https://www.nptel.ac.in/courses/106/101/1061011632. *https://www.coursera.org/courses?query=software testing*

SELF LEARNING EXERCISES:

Automated Testing tools: QTP tools, Lab View etc, ATLM.

Detailed Syllabus
Semester -6

Course Title	Information and Network Security				Course Type		Theory	
Course Code	B20EJ0601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices in Intrusion Detection Systems	1 to 5	1
CO2	Make use of the different cryptographic algorithms for encryption and decryption of given data.	1 to 5	2
CO3	Compare the various performance of protocols used for authentication.	1 to 5	2,3
CO4	Identify security in different layers of OSI for solving real world network problems	1 to 5	1
CO5	Relate different firewalls available for more security	1 to 5	2,3
CO6	Identify different auditing tools for intrusion management system.	1 to 5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√	√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	2	3									3	3
CO4	2	2	2	1	1									3	3
CO5	2	2	3	3	1									2	3
CO6	2	2	3	3	2									2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
Theory:

Contents
UNIT-1
Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan. **Introduction to Security Technology**: Physical design; Firewalls; Protecting Remote Connections.; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

UNIT-2
Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services , Security Mechanisms, A Model for Network Security Symmetric Ciphers, Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography , Block Ciphers and the Data Encryption , The Data Encryption Standard, A DES Example, Block Cipher Design Principles, Advanced Encryption Standard . Public-Key Cryptosystems , The RSA Algorithm , Diffie-Hellman Key Exchange,
UNIT-3
Authentication Applications: Kerberos, X.509 Directory Authentication Service. **Electronic Mail Security:** Pretty Good Privacy (PGP); S/MIME. **Transport level Security, Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches, SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Hand shake Protocol, Cryptographic Computations.
UNIT-4
Firewalls: Introduction, Identification, Authentication, Authorization, Accountability, Firewall processing modes, Firewalls categorized by generation, Firewalls categorized by structure, Firewalls architectures, Selecting of right firewalls, Content Filters, Protecting remote connections, Remote Access, Virtual Private Networks. **Intrusion Detection and Prevention Systems**: IDPS terminology, Use of an IDPS, Types of IDPS, IDPS detection methods, IDPS response, Selecting IDPS approaches and products, Strength and limitations of IDPS, Honeypots. Tools: Auditing tools, Pocket PC hacking, wireless hack walkthrough

TEXT BOOKS:

l. William Stallings, Cryptography and Network Security, Pearson Publications, 6th edition,20l4.
2. M. E. Whitman and Herbert J. Mattored, Principles of Information Security, Information Security Professional, 4thedition, 20l4.

REFERENCE BOOKS:

l. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill, 2007.

2. Joseph MiggaKizza, Guide to Computer Security, Springer Science & Media Inc., 3rd edition, 20l5
3. Springer Journal of Cryptographic Engineering, ISSN 2l90-8508
4. ACM, ACM- International Journal of Applied Cryptography,ISSN:l753-0563
5. IEEE, IEEE Transactions on Information Forensics and Security.
6. Elsevier, Journal of Information Security and Applications

JOURNALS/MAGAZINES

1. Springer Journal of Cryptographic Engineering,https://www.springer.com/journal/13389
2. ACM- International Journal of Applied Cryptography, https://dl.acm.org/citation.cfm?id=J1105
3. IEEE Transactions on Information Forensics and Security, https://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=10206
4. Elsevier, Journal of Information Security and Applications, https://www.journals.elsevier.com/journal-of-information-security-and-applications

SWAYAM/NPTEL/MOOCs:

2. https://www.coursera.org/learn/crypto
3. https://nptel.ac.in/courses/106/105/106105031/

SELF-LEARNING EXERCISES:

Computer networks (B20IS5030).

Course Title	Information Retrieval Systems				Course Type		Theory	
Course Code	B20EQ0601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

Information retrieval is the process through which a computer system can respond to a user's query for text-based information on a specific topic. IR was one of the first and remains one of the most important problems in the domain of natural language processing (NLP). Web search is the application of information retrieval techniques to the largest corpus of text anywhere -- the web -- and it is the area in which most people interact with IR systems most frequently.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the basic concepts of the information retrieval and its models.
2. Illustrate the use of query languages and its operations in real world applications
3. Demonstrate the use of user interfaces and visualization for search process
4. Explain the multimedia IR models, Indexing and searching the web concepts.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline basic concepts of the information retrieval.	1 to5	2
CO2	Apply appropriate Query technique on given real world applications	1 to5	2
CO3	Develop user interfaces and visualization for search process to address research issues.	1 to5	2
CO4	Identify appropriate indexing and searching method for Feature Extraction.	1 to5	2
CO5	Demonstratetheuseofuserinterfacesandvisualizationforsearchprcess	1 to5	2
CO6	Explain the multimedia IR models, Indexing and searching the web concepts	1 to5	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√				
CO2			√			
CO3						√
CO4				√	√	
CO5		√		√		
CO6		√				

COURSE ARTICULATION MATRIX:

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1										3
CO2	2	3	2	1	2										3
CO3	2	2	2	2	1										3
CO4	2	2	3	1	2										3
CO5	2	3	2	1	2										3
CO6	2	2	2	2	1										3

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT-1 INTRODUCTION TO INFORMATION RETRIEVAL AND MODELING **Introduction:** Basic Concepts, The Retrieval Process. Modelling: Introduction, classic Information Retrieval, Alternative set Theoretic Models, Alternative Algebraic Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Models for browsing, Trends and research Issues.
UNIT-2 QUERY LANGUAGES AND QUERY OPERATIONS **Query languages:** Introduction, keyword querying, Pattern Matching, Structural Queries, Query Protocols, Trends, and research issues. Query Operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis, Trend and Research Issue. **Text Operations:** Document Preprocessing, Document Clustering, Text Compression, Comparing Text compression Techniques. Indexing and Searching: Inverted files, Boolean Queries, Sequential Searching, Pattern Matching, Structural Queries, Compression.
UNIT-3 USER INTERFACES AND VISUALIZATION Human-computer Interaction, The information Access Process, Starting points, Query specification, context, using Relevance judgments, interface support for the search process, trends and research issues
UNIT-4 MULTIMEDIA IR Data Modelling, Query languages, Trends and research issues. Indexing and searching: A generic Multimedia indexing Approach, One-dimensional Time series, Two-dimensional color images, Automatic Feature Extraction. **Searching the web:** Challenges, Characterizing the web, Search engines, Browsing, Meta searchers, Finding the needle in the Haystack, Searching using Hyperlinks.

TEXT BOOKS:

1. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.

2. William B.Frakes,Ricardo Baeza-Yates "Information Retrieval: Data Structures and Algorithms" Fifth edition, Pearson,2012.

REFERENCE BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2nd Edition, Springer, 2004.

JOURNALS/MAGAZINES

1. Springer Journal on Information Retrieval (https://link.springer.com/journal/10791)

SWAYAM/NPTEL/MOOCs:
https://www.nptel.ac.in/courses/106/101/106101007

SELF LEARNING EXERCISES:

Introduction about Text and Multimedia languages and properties, Meta data, text, Markup Languages, Multimedia

Course Title	VIRTUALIZATION & CLOUD COMPUTING (PE-II)				Course Type		Theory	
Course Code	B20EQS601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure.

COURSE OBJECTIVE

1. Introduce cloud computing and provide knowledge in different layers of cloud computing such as: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
2. Describe various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology
3. Explain Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization.
4. Provide knowledge about cloud security and threats
5. Gain expertise in cloud security mechanisms

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the cloud computing concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)	1-5	2
CO2	Use various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology	1-5	3
CO3	Apply Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization in developing cloud applications.	1-5,10	1,3
CO4	Analyze cloud security and threats for new problems in hand and develop and provide security services for cloud based applications	1-5, 10,11	2,3
CO5	Learn new tools and technologies in Virtualization and cloud computing concepts and apply for suitable solutions for application development.	12	2,3
CO6	Develop solutions in Virtualization and cloud computing concepts to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2			√	√		
CO3			√	√		
CO4				√	√	√
CO5		√		√		
CO6			√	√		√

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1					2				3	
CO2	2	2	2	3	2					3					3
CO3	2	3	3	3	3					2			3		3
CO4	2	2	3	3	2					2	1			3	3
CO5												2	3		
CO6	2					2			2		2			3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. **Fundamental Concepts and Models:** Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.
UNIT-2

Cloud Computing Technologies: Broadband networks and internet architecture, data center technology, virtualization technology, web technology, multitenant technology, service technology Cloud Infrastructure **Mechanisms:** Logical Network Perimeter,Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-made environment
UNIT-3
Specialized Cloud Environment: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-per-use monitor, Audit Monitor, Failover System, Hypervisor, Resource cluster, Multi-device Broker, State Management **Cloud Management Mechanisms:** Remote Administration System, Resource Management System, SLA Management System, Billing Management System.
UNIT-4
Virtualization: Implementation levels of virtualization, virtualization structures/tools and mechanisms, virtualization of CPU, memory and I/O devices.

TEXT BOOKS:

1. Thomas Erl , Ricardo Puttini , Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI, 2013.
2. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra, Distributed and Cloud Computing, MK, 2012.

REFERENCE BOOKS:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, MK
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms,Wiley.
4. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing, A practical approach, TATA McGRAW HILL.
5. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications, CAMBRIDGE.
6. David Marshall, Wade A. Reynolds and Dave McCrory, Advanced Server Virtualization-VMware and Microsoft Platforms in the Virtual Data Center, AUERBACH Publications.

JOURNALS/MAGAZINES:

1. International Journal of Cloud Computing, INDERSCIENCE Publishers.
2. IEEE Cloud Computing
3. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

SWAYAM/NPTEL/MOOCS:

1. https://onlinecourses.nptel.ac.in/noc21_cs15/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://www.classcentral.com/course/swayam-cloud-computing-and-distributed-systems-17544

SELF LEARNING EXERCISES:

1. https://www.cybrary.it/course/virtualization-management/
2. http://cds.iisc.ac.in/faculty/simmhan/SE252/
3. https://data-flair.training/blogs/hardware-virtualization-in-cloud-computing/

Course Title	Advanced Database (PE-II)				Course Type		Theory	
Course Code	B20EQS602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

Advanced database system deals with current and emerging technologies which enables to handle complex applications, provides a comprehensive understanding of data modelling techniques, OLAP, OLTP, Data warehouse and its practical implementation.

COURSE OBJECTIVE (S):

1. Discuss object-oriented concepts and object relational data bases
2. Describe Parallel and distributed database.
3. Illustrate queries for distributed data storage and processing.
4. Explain enhanced data models for applications

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the features of Object Definition Language and Object Query Language for given real world applications	1 to6	1
CO2	Develop Complex queries in SQL and ODMG for parallel and distributed databases.	1 to6	1
CO3	Make use of different types of databases and other technologies to mine the data.	1 to6	1
CO4	Design multi dimension model for a given application in Data mining.	1 to6	1,2,3
CO5	Understand of data modelling techniques, OLAP,OLTP	1-6	1,2
CO6	Practical implementation of advanced data base system	1-6	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√
CO5		√				√
CO6	√	√	√	√	√	√

COURSE ARTICULATION MATRIX

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2									3	-	-
CO2	3	3	2	3									3	-	-
CO3	1		3	1									3	-	-
CO4	3	3		2									3	3	3
CO5	1	2	3	1									1	2	
CO6	3	3	3	2									2	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Theory

Contents
UNIT-1
Introduction to various tools and frameworks: Introduction to OLAP, OLTP and Data warehouse system, data modelling, star schema, snowflake schema. Build Data warehouse/data mart using opensource tools like pentaho data integration tool, pentaho business analytics. OLAP versus OLTP, Introduction tovarious tools Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL;

Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.
UNIT-2
Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.
UNIT-3
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases - Basic concepts
UNIT-4
Data Warehousing and Data Mining: Introduction to decision support, OLAP, multidimensional model, Window queries in SQL, finding answers quickly, Implementation techniques for OLAP, Data Warehousing, Introduction to Data Mining, Counting co-occurrences, Mining for rules, Tree-structured rules, Clustering, Similarity search over sequences, Incremental mining and data streams;

TEXTBOOKS:

2. 1.Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3rd Edition, McGraw- Hill, 2003.
3. 2.Elmasri and Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2007.
4. 3.Jiawei Han, MichelineKamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier, 2011.

REFERENCEBOOKS:

1. 1.Connolly and Begg, “Database Systems”, 4th Edition, Pearson Education, 2002.

JOURNALS/MAGAZINES:

4. https://dl.acm.org/journal/jdiq
5. https://dl.acm.org/journal/tkdd
6. https://dl.acm.org/journal/tods
7. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69
8. https://www.springer.com/journal/10618

SWAYAM/NPTEL/MOOCs:

1. Coursera – Database Management Essentials, University of Colorado System
2. Coursera – Databases and SQL for Data Science, IBM
3. https://www.edx.org/course/advanced-database-administration
1. https://www.edx.org/course/olap-and-recursion
2. https://www.edx.org/course/advanced-database-queries

Self-Learning Exercises:

1. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management, P-P database.
2. Transaction management.

Course Title	BIG DATA ANALYTICS (PE-II)				Course Type		Theory	
Course Code	B20EQS603	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including Hadoop and Spark.

COURSE OBJECTIVE

The objectives of this course is to:

1. Explain the concepts of Big Data and its Business Implications.
2. Describe the framework for Scala and Spark for Big-Data Analytics.
3. Discuss the use of features of Apache Spark for Data Analytics.
4. Demonstrate solving of Business Problems with Machine Learning in Spark and Scala.
5. Learn new tools and technologies in Big Data Analytics and apply for suitable solutions for application development.
6. Develop solutions in Big Data Analytics to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make us of the concepts of Big Data in real world application.	1 to 5, 9,12	2
CO2	Apply the theories of Hadoop in Scala for Big Data Analytics.	1 to 5, 9,12	2
CO3	Design a Data Analytics Framework using Apache Spark with Scala.	1 to 5, 9,12	1
CO4	Develop a real world application using Apache Spark with Scala.	1 to 5, 9,12	1
CO5	Learn new tools and technologies in Big Data Analytics and apply for suitable solutions for application development.	12	2
CO6	Develop solutions in Big Data Analytics to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1 to 5,9,12	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√			
CO3						√
CO4				√	√	√
CO5			√			
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2					1			3		3	
CO2	3	3	3	3					1			3		3	
CO3	3	3	3	3					1			3	3		
CO4	3	3	3	3					2			3	3		
CO5												3			
CO6					3				3	3	3				3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1

The Age of the Data Product: What Is a Data Product?, Building Data Products at Scale with Hadoop, Leveraging Large Datasets, Hadoop for Data Products, The Data Science Pipeline and the Hadoop Ecosystem, Big Data Workflows. **An Operating System for Big Data**: Basic Concepts, Hadoop Architecture, A Hadoop Cluster, HDFS, YARN, Working with a Distributed File System, Basic File System Operations, File Permissions in HDFS, Other HDFS Interfaces, Working with Distributed Computation,
UNIT-2
MapReduce: A Functional Programming Model, Implemented on a Cluster, Beyond a Map and Reduce: Job Chaining, Submitting a MapReduce Job to YARN. **Scala Programming:** Functional Programming Aspects, What Is Functional Programming? Scala Programming Features, Functional Programming Aspects of Scala.
UNIT-3
Introduction to Apache Spark and Spark Core: What Is Apache Spark?, Why Apache Spark?, Spark vs. Hadoop MapReduce, Apache Spark Architecture, Spark Components, Spark Shell. **Spark Core:** RDD, RDD Transformations, RDD Actions, Working with Pair RDDs, Direct Acylic Graph in Apache Spark, Persisting RDD Shared Variables, Simple Build Tool (SBT).
UNIT-4
Spark SQL, DataFrames, and Datasets: What Is Spark SQL?, Spark Session, Creating DataFrames. **Introduction to Spark Streaming:** Data Processing, Streaming Data, Introduction to Spark Streaming, Spark Streaming Example Using TCP Socket, Stateful Streaming, Streaming Applications Considerations. **Spark Machine Learning Library:** What Is Spark MLlib?, Spark MLlib APIs, Vectors in Scala, Basic Statistics, Extracting, Transforming, and Selecting Features, ML Pipelines.

TEXT BOOKS:

1. Sridhar Alla, “Big Data Analytics with Hadoop 3”, published by Packt Publishing Ltd, May 2018
2. Subhashini Chellappan, Dharanitharan Ganesan,” Practical Apache Spark Using the Scala API”, A Press, 2018.

REFERENCE BOOKS:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj,” Big data, big analytics”, Wiley,2013
2. P. Tan, M. Steinbach, V. Kumar, “Introduction to Data Mining”, Addison-Wesley, 2005.
3. J. Han, M. Kamber, “Data Mining: Concepts and Techniques”, 2nd ed. Morgan Kaufmann, 2005.

JOURNALS/MAGAZINES:

1. IEEE,Introduction to the IEEE Transactions on Big Data
2. Elsevier, Big data research journal Elsevier
3. Springer, Journal on Big Data Springer.
4. ACM DL,The Journal of Machine Learning Research-ACM

SWAYAM/NPTEL/MOOCS:

Coursera – Big Data, Coursera – Introduction to Big Data,
https://nptel.ac.in/courses/106/104/106104189/
https://www.edx.org/learn/big-data

SELF-LEARNING EXERCISES: Spark Real-Time Use Case: Data Analytics Project Architecture, Data Ingestion, Data Storage, Data Processing, Data Visualization

Course Title	Block Chain Technology (PE-II)				Course Type		Theory	
Course Code	B20EJS604	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Block chain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called block chain. Block chains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

COURSE OBJECTIVE (S):

1. Describe the basic concepts of Cryptography and Block chain technology.
2. Explain the features of the block chain technology, decentralised applications and smart contract.
3. Demonstrate building of decentralised applications by deploying Smart Contracts
4. Analyse different Blockchain Platforms that can be used in real world applications.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the concepts of block chain technology suitable for given rea world applications	1-9	1
CO2	Compare the performance of POW and POS mining consensus algorithm with respect to given real world application.	1-11	2
CO3	Build a decentralised application by implementing smart contract using solidity programming language.	1-10	2
CO4	Apply various block chain platforms for solving real world problems.	1-12	2
CO5	Analysis new Block Chain technologies for real world problem	1-11	3
CO6	Prepare the security algorithm for securing block chains	1-12	3

BLOOM'S LEVELOF THECOURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√		√		
CO3		√				
CO4			√			
CO5				√	√	
CO6			√	√		√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2									3		
CO2	3		2	3							3			3	
CO3	2	3	3	2										3	
CO4	2	3		2							3	2			3
CO5		3	2	3							3				3
CO6	3	2	3	2							3	3			3

Note:1-Low,2-Medium,3-High

COURSE CONTENT:
THEORY:

Contents
UNIT-1
Introduction to Cryptography and Block chain: Introduction to cryptography-Symmetric- key cryptography, Public-key cryptography, Digital Signatures and Elliptic Curve Cryptography. Introduction to Block chain: Types of Block chain, Structure of a Block, Block Header, Block Header Hash and Block Height, Genesis Block, Linking Blocks in the Block chain, Merkle Trees, Constructing the Block Header. Mining and Consensus: The Byzantine general's Problem, Consensus mechanism-proof of work & proof of stake, Bit coin mining and Block chain Forks
UNIT-2
Overview of Ethereum: What Is Ethereum? Compared to Bitcoin, Ethereum: A General-Purpose Block chain, Ethereum Accounts (Externally Owned Accounts and Contracts), Ethereum and Turing Completeness, Decentralized Applications, Decentralized Autonomous Organizations, Smart Contract Introduction, Life Cycle of a Smart Contract.

UNIT-3
Dapp development on Ethereum: Programming Solidity: Structure, Basic Data Types & Statements, Specific Data Types, Data Structures, Memory vs Storage, Access Modifiers, Contract Definition, Functions, Contract Constructor, The Ethereum Contract ABI, Events, Run Ethereum Dapps, Develop a simple smart contract.
UNIT-4
Enterprise Block chains and Applications: Enterprise Block chains: Hyper ledger, R3 Corda, Quorum Block chain Applications: Identity management, Auction, Food industry supply chain and Block chain in Health care.

TEXT BOOKS:

1. Joseph J. Bambara Paul R. Allen," Block chain, A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill Education Professional, Second edition, 2018.
2. Melanie Swan "Block chain: Blueprint for a New Economy", O'Reilly Media, Third edition, Aug 2015.
3. Andreas M. Antonopoulos, Gavin Wood "Mastering Ethereum", O'Reilly Media, Inc.,November 2018.
4. Joseph Holbrook "Architecting Enterprise Block chain Solutions", Sybex, February 2020.

REFERENCE BOOKS:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts "Packt , 2nd edition 2018.
2. Jimmy Cooper, "Block chain Blueprint: Guide to Everything You Need to Know About Block chain Technology and How It Is Creating a Revolution ",Create Space Independent Publishing Platform, 2017.

JOURNALS/MAGAZINES:

1. Deepak Puthal, Nisha Malik, Saraju P Mohanty, Elias Kougianos, Chi Yang, "The Blockchain as a Decentralized Security Framework [Future Directions]" Volume 7, Issue 2, Pages 18 – 21, 2018.
2. Valentina Gatteschi, Fabrizio Lamberti, Claudio Demartini, Chiara Pranteda, Víctor Santamaría," To Blockchain or Not to Blockchain: That Is the Question ", Volume 20, Issue 2 Pages 62 - 74, 2018.
3. Tien Tuan Anh Dinh, Rui Liu, Meihui Zhang, Gang Chen, Beng Chin Ooi, Ji Wang "Untangling Blockchain: A Data Processing View of Blockchain Systems", Volume 30, Issue 7, Pages 1366 – 1385, 2018.
4. Mingjun Dai, Shengli Zhang, Hui Wang, Shi Jin, "A Low Storage Room Requirement Framework for Distributed Ledger in Blockchain", Volume 6, Pages 22970 – 22975, 2018.
5. Ruiguo Yu, Jianrong Wang, Tianyi Xu, Jie Gao Yongli An Gong Zhang, And Mei Yu "Authentication With Block-Chain Algorithm and Text Encryption Protocol in Calculation of Social Network ", Volume5, Pages 24944 – 24951, 09 November 2017.
6. Ashiq Anjum, Manu Sporny. Alan Sill, "Blockchain Standards for Compliance and Trust", Volume 4, Issue 4, Pages 84 – 90, 2017.
7. Morgen E. Peck, Samuel K Moore, "The blossoming of the blockchain", Volume 54, Issue 10 Pages 24 – 25, 2017.
8. Inderscience Journal of Blockchain and Cryptocurrency.
9. Ledger Journal of Cryptocurrency and Blockchain Technology.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/104/106104220/
2. https://www.coursera.org/specializations/blockchain

SELF-LEARNINGEXERCISES: Distributed Ledger in Blockchain, Decentralized Applications.

Course Title	MULTI AGENT SYSTEMS(PE-II)				Course Type		Theory	
Course Code	B20EQS605	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Multi-agent systems have emerged as one of the most important areas of research and development in information technology. A multi-agent system is one composed of multiple interacting software components known as agents, which are typically capable of cooperating to solve problems that are beyond the abilities of any individual member. Multi-agent systems are important primarily because they have been found to have very wide applicability, in areas as diverse as industrial process control and electronic commerce. This module will begin by introducing the student to the notion of an agent, and will lead them to an understanding of what an agent is, how they can be constructed, how agents can be made to cooperate effectively with one another to solve problems, and approaches to decision making in multiagent contexts.

COURSE OBJECTIVE

The objectives of this course are to:

1. Describe the notion of an agent & its application areas.
2. Discuss the abstract agent architecture & types of agents
3. Understand the key issues in designing societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems
4. Understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform.
5. Use The Prisoner's Dilemma concept to solve similar real-world problem.
6. Illustrate how to solve problems on zero-sum and mixed strategy problems in real world scenario

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the different types of multiagent systems	1,2,3,11	1
CO2	Discover the role of the agent concept in a distributed environment.	2,5,7,8	1,2
CO3	Appraise and use an appropriate framework for agent communication and information sharing processes	2,4,5,8	2
CO4	Make use of the detailed knowledge of the different research methods for solving real world problems.	7,11	3

CO5	Use The Prisoner's Dilemma concept to solve similar real-world problem	7,11,12	3
CO6	Illustrate how to solve problems on zero-sum and mixed strategy problems in real world scenario	7,11,12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√			
CO3			√	√		
CO4	√		√	√		
CO5			√	√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3								3		2		
CO2		1			2		2	2					1	3	
CO3		3		3	2			3						3	
CO4							3				3				2
CO5							1				2	1			3
CO6							1				1	1			3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents

UNIT-1
Introduction: The Vision Thing, Some Views of the Field, Agents as a paradigm for software engineering, Agents as a tool for understanding human societies. Intelligent Agents: Intelligent Agents, Agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems.
UNIT-2
Intelligent Agents: Abstract architectures for agents; Deductive Reasoning Agents, Practical Reasoning Agents, Reactive and Hybrid Agents.
UNIT-3
Multiagent Systems: Ontologies: Ontology Fundamentals, Ontology building blocks, An ontology of ontologies, OWL, KIF, RDF; Constructing an Ontology, Communicating: speech acts, Agent Communication Languages KQML/KIF, the FIPA framework; cooperation: cooperative distributed problem solving (CDPS), Task Sharing and Result Sharing, Coordination: partial global planning, Applications
UNIT-4
Multiagent Decision-Making: multi-agent interactions: solution concepts; pure and mixed strategy Nash equlibria; Pareto efficiency, zero-sum and other interactions; The Prisoner's Dilemma **Making Group Decisions:** Social Welfare Functions and Social Choice Functions, Voting Procedures

TEXT BOOKS:

1. M. Wooldridge, "An Introduction to Multi Agent Systems", Second Edition, John Wiley & Sons, 2009.

REFERENCE BOOKS:

1. Y. Shoham and K. Leyton-Brown, "Multiagent Systems: Algorithmic, Gamer-Theoretic, and Logical Foundations",
Cambridge UP, 2008.
2. G. Weiss, editor, "Multi-Agent Systems", The MIT Press, 1999.
3. M. Singh and M. Huhns, "Readings in Agents", Morgan-Kaufmann Publishers, 1997.

JOURNALS/MAGAZINES:

1. https://opensky.ucar.edu/islandora/object/articles:21155
2. https://cs.cit.ie/contentfiles/PDFs/MScFlyers/MScAI_FT.pdf
3. https://www.enterrasolutions.com/news/trends-predictions-2017-digital-transformation-2/
4. https://www.wsj.com/articles/readers-beware-ai-has-learned-to-create-fake-news-stories-11571018640

SWAYAM/NPTEL/MOOCS:

1. https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020 ec77ad13bdc1
2. https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020- ec77ad13bdc1
3. https://javarevisited.blogspot.com/2020/08/top-10-coursera-courses-and-certification-for-artificial-intelligence-and-machine-learning.html#axzz6jQ05pXOG

SELF LEARNING EXERCISES:

1. Fixed-time/ Finite time cooperative control in Multi Agent systems and Prolog programming language for artificial intelligence.
2. Multi-Agent Systems and Agent Communication for distributed problem solving which is performed by agents working together towards a solution of a common problem.

Course Title	NEURAL NETWORKS & DEEP LEARNING (PE-II)				Course Type		Theory	
Course Code	B20EJS606	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Neural Networks are an effective programming paradigm that enable a computer to learn from observed data. They simulate biological learning of the nervous system and have been demonstrated to increase the power of known machine learning models by stacking them as computational graphs. This is different from conventional programming where human programmers define the set of tasks to be carried out by a computer to solve a problem. Deep learning is a subset of machine learning that uses many layers of neural networks to accomplish tasks like image recognition, text procession, speech recognition, natural language processing etc. This course aims at giving the students the knowledge and the skills required to model the solutions to real world problems using neural networks and deep learning.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the fundamentals of neural network based paradigm to problem solving.
2. Inculcate knowledge of concepts involved in training of neural networks.
3. Discuss the concepts and issues in deep neural networks.
4. Explain generalizability of deep neural networks and introduce prominent deep neural architectures.
5. Illustrate the applications of CNN for solving real world Problems.
6. Analyze the applications of CNN for solving real world Problems

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental architecture of neural network and the concepts involved.	1,2,3,4,5	1,2
CO2	Apply the shallow neural network models - Perceptron, Least-Squares Regression, Logistic Regression, Support Vector machines to solve real world binary and multiclass classification problems.	1,2,3,4,5	1,2
CO3	Develop simple deep neural networks to solve problems in unsupervised learning.	1,2,3,4,5	1,3

CO4	Create deep neural models like CNN and RNN to solve problems.	1,2,3,4,5	1,3
CO5	Illustrate the applications of CNN for solving real world Problems	1,2,3, 11, 12	1,3
CO6	Analyze the applications of CNN for solving real world Problems	1,2,3, 11, 12	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√	√		√
CO3			√	√		√
CO4			√	√	√	√
CO5			√	√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	1	2	1								2	2	
CO2	3	2	3	1	2								2	2	
CO3	3	1	2	1	2								2		2
CO4	3	2	2	2	2								2		2
CO5	3	2	2								1	1			
CO6	3	2	3								1	1			

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Neural Networks: The basic architecture of Neural Networks – Single computational layer – The Perceptron, What Objective Function Is the Perceptron Optimizing? , Relationship with Support Vector Machines Choice of Activation and Loss Functions, Some Useful Derivatives of Activation Functions Choice and Number of Output Nodes multilayer neural network, The Multilayer Network as a Computational Graph, Training a Neural Network with Backpropagation, Practical Issues in Neural Network Training -The Problem of Overfitting, The Vanishing and Exploding Gradient Problems **Common Neural Architectures** - Simulating Basic Machine Learning with Shallow Models, Radial Basis Function Networks, Restricted Boltzmann Machines, Recurrent Neural Networks, Convolutional Neural Networks, Two Notable Benchmarks - The MNIST Database of Handwritten Digits, The ImageNet Database
UNIT-2
Machine Learning with Shallow Neural Networks - Neural Architectures for Binary Classification - Revisiting the Perceptron, Least-Squares Regression, Logistic Regression, Support Vector machines, Neural Architectures for Multiclass Models - Multiclass Perceptron, Weston-Watkins SVM, Multinomial Logistic Regression (Softmax Classifier), Hierarchical Softmax for Many Classes, Auto encoder: Basic Principles, Nonlinear Activations, Deep Auto encoders, Application to Outlier Detection, When the Hidden Layer Is Broader than the Input Layer, Word2vec: An Application of Simple Neural Architectures, Simple Neural Architectures for Graph Embeddings
UNIT-3
Deep Neural Networks – Introduction, Backpropagation - Backpropagation with the Computational Graph Abstraction, Backpropagation with Post-Activation Variables, Backpropagation with Pre-activation Variables, Examples of Updates for Various Activations, Loss Functions on Multiple Output Nodes and Hidden Nodes, Setup and Initialization Issues - Tuning Hyper-parameters, Gradient-Descent Strategies- Learning Rate Decay, Momentum-Based Learning - Nesterov Momentum, Parameter-Specific Learning Rates – AdaGrad, RMSProp, Adam, Gradient Clipping, Second-Order Derivatives, Batch Normalization.
UNIT-4
Teaching Deep Learners to Generalize- The Bias-Variance Trade-Off, Generalization Issues in Model Tuning and Evaluation, Issues with Training at Scale, Penalty-Based Regularization - L1-Regularization, L1- or L2-Regularization, Penalizing Hidden Units: Learning Sparse Representations, Ensemble Methods- Bagging and Subsampling, Parametric Model Selection and Averaging, Randomized Connection Dropping, Dropout, Data Perturbation Ensembles, Early Stopping. **Prominent Deep Learning Models** - **Restricted Boltzmann Machines** – The Boltzmann Machine, How a Boltzmann Machine Generates Data, Training the RBM, **Recurrent Neural Networks** - The Architecture of Recurrent Neural Networks, Long Short-Term Memory (LSTM), **Convolutional Neural Networks** - The Basic Structure of a Convolutional Network Training a Convolutional Network, **Deep Reinforcement Learning** - The Basic Framework of Reinforcement Learning

TEXT BOOKS:

1. Charu Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press

REFERENCE BOOKS:

1. Francis Chollet, “Deep Learning with Python”, Manning, 2018.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishing Company, 1995.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Macmillan College Publishing Company, 1994.
4. Mohamad H. Hassoun, Fundamentals of Artificial Neural Networks, The MIT Press, 1995.
5. Laurene Fausett, Fundamentals of Neural Networks: Architectures, Algorithms, and Applications, Prentice Hall International, Inc., 1994.
6. B. D. Ripley, Pattern Recognition and Neural Networks, Cambridge University Press. 1996.

JOURNALS/MAGAZINES

1. IEEE Transactions on Neural Networks and Learning Systems https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385

a. IEEE Transactions on Pattern Analysis and Machine Intelligence https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf

2. International Journal of Intelligent Systems https://onlinelibrary.wiley.com/journal/1098111x
3. http://www.charuaggarwal.net/neural.htm
4. http://neuralnetworksanddeeplearning.com/
5. https://github.com/mnielsen/neural-networks-and-deep-learning
6. deeplearning.stanford.edu
7. http://yann.lecun.com/exdb/mnist/
8. University of California Irvine Machine Learning Repository - https://archive.ics.uci.edu/ml/datasets.php
9. https://peterroelants.github.io/posts/rnn-implementation-part01/
10. https://victorzhou.com/blog/keras-rnn-tutorial/

SWAYAM/NPTEL/MOOCs:

1. Swayam Nptel – Deep Learning – IIT Ropar https://onlinecourses.nptel.ac.in/noc21_cs35/preview
2. Coursera – Neural Networks and Deep Learning Andrew Ng
3. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

Self-Learning Exercises:

1. Experiment with problems on Kaggle.com
2. Tweak the given solutions with changes to hyper-parameters

Course Title	Image Processing and Computer Vision (PE-III)				Course Type		Theory	
Course Code	B20EQS607	Credits	3		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50**	**50**

COURSE OVERVIEW

The course provides students with fundamental concepts and techniques for digital image processing and computer vision. It gives an overview of sampling and quantization, various techniques used for image enhancement, segmentation and compression

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the fundamentals of digital image processing and its applications
2. Get exposed to various image enhancement segmentation and compression techniques.
3. Become familiar with image processing techniques for computer vision and three-dimensional image analysis

techniques

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the fundamentals of digital image processing, representation and various applications	1 to 5	1
CO2	Learn image enhancement techniques for spatial and frequency domain	1 to 5	2
CO3	Discuss and compare various image segmentation and compression techniques	1 to 5	3
CO4	Understand image processing techniques for computer vision and 3 D image analysis	1 to 5	3

CO5	Use Methods for 3D vision fir solving real world problems	1 to 5	3
CO6	Illustrate Image segmentation on a real world dataset	1 to 5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2								3		
CO2	3	3	2	1	3									3	
CO3	3	3	3	2	2										3
CO4	3	3	3	1	1										3
CO5	3	3	3	1	1							1			3
CO6	3	3	3	1	1						2				3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels, File Formats, colour images and models, Image Operations – Arithmetic, logical, statistical and spatial operations, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing

UNIT – 2

Image enhancement : Spatial domain- Gray level transformations, Histogram processing, Spatial filtering, Smoothing and sharpening, Frequency domain- Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain

UNIT – 3

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking and boundary detection. Image Compression: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Block transform coding

UNIT – 4

Introduction: What is Computer Vision: Image Formation, Geometric primitives and transformations, 3-D Vision and motion Introduction, 3-D Vision, Methods for 3D vision, projection schemes, shape from shading, photometric stereo, shape from texture, shape from focus, Surface representations, point-based representation, volumetric representations, Model-based reconstruction

TEXT BOOKS:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India
2. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2008, New Delhi.
3. S.Sridhar, “Digital Image Processing”, Oxford University Press, 2011, New Delhi
4. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009
5. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012

JOURNALS/MAGAZINES

1. https://signalprocessingsociety.org/publications-resources/ieee-signal-processing-magazine
2. https://www.computer.org/web/tpami
3. http://signalprocessingsociety.org/publications-resources/ieee-transactions-image-processing

SWAYAM/NPTEL/MOOCs:

1. Coursera – Fundamentals of Digital image and video processing by North Western University
2. Coursera – Computer Vision Basics by University of Buffalo, The State University of New York
3. https://nptel.ac.in/courses/106/105/106105032/

Self-Learning Exercises:

1. Sharpening Spatial Filters, Combining Spatial Enhancement Methods

2. Image Compression: DCT implementation using FFT

3. Applications: Face detection and Face recognition, 3D shape models of faces application

Course Title	Data Centre Technology (PE-III)				Course Type		Theory	
Course Code	B20EQS608	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW

Understanding of Network Infrastructure management, Understanding of Server Management and troubleshooting, understanding of system Resource Management, Understanding of Information Security

COURSE OBJECTIVE (S):

- Manage Server Systems and Data Centres Infrastructure Management
- Utilize the Storage, Bandwidth, Efficiency of systems and other resources for Data centre.
- Monitoring the Networks and Resources.
- Planning for Flexible resource allocation.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Introducing Data Center Technologies, Architecture, Infrastructure	1, 2	1
CO2	Data Center Design and Characteristics	1,3	1
CO3	Data Center maintenance, planning and ISP	2,3	2
CO4	Data Center serves and Planning and Network support system	2,3,4,12	1
CO5	Data Center server Analysis with Network load balancing	1,2,3,4,5,6,9,12	2
CO6	Build the data center with basic servers	1,2,3,4,5,6,11,12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√		√		
CO2			√	√		
CO3		√				
CO4		√	√	√	√	√
CO5				√		
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3		2												
CO3		2	3												
CO4		2	2	3								3			
CO5	3	3	3	2	3	2			3			3			
CO6	3	3	3	2	3	2					2	3			

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1
Introduction to Data Centers - Data center Architecture, Data center Requirements, Data center prerequisites, Required Physical Area for Equipment and Unoccupied Space, Required power to run all the devices, Required cooling and HVAC Required weight, Required Network bandwidth, Budget Constraints, Selecting a Geographic Location Safety from Natural hazards Safe from Manmade disaster, Availability of local Technical talent, Abundant and Inexpensive Utilities,
UNIT – 2
Selecting an Existing building, Data Center design, Characteristics of an Outstanding Design Guidelines for Planning a Data Center, Data Center structures, Raised Floor Design and Deployment, Design and Plan against Vandalism, Data center design case study
UNIT – 3

Modular Cabling Design, Points of Distribution, ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance, Network Operations Center, Network Monitoring, Datacenter physical security, Data center Logical security, Data center Consolidation, Reasons for data center Consolidation, Consolidation opportunity, Server consolidation, Storage Consolidation, Network Consolidation, Service Consolidation, Process Consolidation, Staff Consolidation, Data Consolidation phases

UNIT – 4

Data center servers, Sever Capacity Planning, System Management Best Practices, Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Best Practices for System Administration, System Administration Work Automation, Device Naming, Naming Practices, NIS, DNS, LDAP, Load balancing, Terminology, Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches

TEXT BOOKS:

7. Administering Data Centers: Servers, Storage and Voice over IP, Kailash Jayaswal
8. Data center fundamentals, Mauricio Arregoces, Maurizio Portol

REFERENCE BOOKS:

1. Chang, Frank. Datacenter Connectivity Technologies: Principles and Practice. Stylus Publishing, LLC, 2019.
2. Lee, Gary. Cloud networking: Understanding cloud-based data center networks. Morgan Kaufmann, 2014.

JOURNALS/MAGAZINES

1. Khan, Samee U., and Albert Y. Zomaya, eds. "Handbook on data centers." (2015).
2. Cheung, Howard, Shengwei Wang, Chaoqun Zhuang, and Jiefan Gu. "A simplified power consumption model of information technology (IT) equipment in data centers for energy system real-time dynamic simulation." *Applied energy* 222 (2018): 329-342.
3. Sharma, Ratnesh K., Rocky Shih, Cullen Bash, Chandrakant Patel, Philip Varghese, Mohandas Mekanapurath, Sankaragopal Velayudhan, and Manu Kumar. "On building next generation data centers: Energy flow in the information technology stack." In *Proceedings of the 1st Bangalore annual Compute conference*, pp. 1-7. 2008.
4. Uddin, Mueen, Muhammad Talha, Azizah Abdul Rahman, Asadullah Shah, Jameel Ahmed Khader, and Jamshed Memon. "Green Information Technology (IT) framework for energy efficient data centers using virtualization." *International Journal of Physical Sciences* 7, no. 13 (2012): 2052-2065.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Data Technologies

Self-Learning Exercises:

1. Data Center Technologies
2. Data Center and Green Energy

Course Title	Compiler Design (PE-III)				Course Type		Theory	
Course Code	B20EJS609	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: The Course intends to make students learn the techniques needed for compiler construction and develops analytical skills. The course is conceptual.

COURSE OBJECTIVE (S):

1. Explain the concepts of Object-Oriented programming, Object-Relational Databases and Compilers.
2. Describe how syntax tree can be constructed to check the syntax of the given input.
3. Discuss different types of parsers and syntax directed definition and translation.
4. Demonstrate how code optimization and code generation is done for a given source code.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Apply the concepts of lexical, syntactic and semantic analysis to parse the given statement.	1-5,8-10	1
CO2	Experiment with the knowledge of different parsers by constructing the top down and SLR parsers.	1-5,7,8,10-12	2
CO3	Make use of different types of parsers and syntax directed definition and translation to check the syntax of the given input.	1-5,8,9,11,12	1
CO4	Develop code optimization and code generation for a given source code.	1-5 ,11,12	2,3
CO5	Apply some algorithms for real time environment	1-12	3
CO6	Develop new algorithms for real world environment	1-12	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√	√		
CO3			√			
CO4						√
CO5			√		√	
CO6				√		√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1							2	2	3		
CO2	2	2	2	1							2	2		3	
CO3	2	2	2	1							1	2	3		
CO4	2	2	2	1							2	2		3	3
CO5	3			2							2	3			3
CO6	2	3	2	1							2	3			3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT-1
Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Introduction to Compilers: Language processors; the structure of a Compiler. **Lexical analysis:** Tokens, Regular expressions, Finite state automata, translating regular expressions into finite state automata;
UNIT-2
Syntax analysis 1: Context-free grammars, Derivations and syntax trees, Handling ambiguous grammars, Top-down parsing, Bottom-up parsing – SLR ();
UNIT-3
Syntax Analysis 2: More powerful LR Parsers. **Syntax-directed translation:** Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Parser stack implementation of Postfix SDT;
UNIT-4
Code optimization and generation: Basic blocks and Flow graphs; Optimization of basic blocks. **Intermediate code generation:** Variants of syntax trees; Three-address code; Control flow; back patching;

TEXT BOOKS:

1. A. V. Aho, R. Sethi and J. D. Ullman, Compilers – Principles, Techniques, and Tools, Addison-Wesley, Pearson Education, 2001.
2. Charles N. Fischer, Richard J. LeBlanc, Jr., Crafting a Compiler with C, Pearson Education, 1991.
3. Kenneth C Louden, Compiler Construction Principles & Practice, Cengage Learning, 1997.

REFERENCE BOOKS:

1. A.W. Appel, Modern Compiler Implementation in Java, Cambridge University Press, 2002.

JOURNALS/MAGAZINES

1. https://www.springer.com/gp/book/9783319669656
2. https://ieeexplore.ieee.org/document/101813
3. IEEE, IEEE Transactions on Computers.
4. Elsevier, Computer Languages, Systems and Structures.
5. Springer, Journal of Logic, Language and Information.
6. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/104/106104123/
2. https://www.mooc-list.com/tags/compilers

SELF-LEARNINGEXERCISES:

More Recent Applications: translating regular expressions into finite state automata; survey of latest compilers for dealing with parallel programming.

Course Title	STORAGE AREA NETWORK (PE-IV)				Course Type		Theory	
Course Code	B20EQS611	Credits			Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**39**	**-**	**50**	**50**

COURSE OVERVIEW

This course provides an overview of storage network and data center networking technology. It reviews SAN concepts, Fibre Channel architecture, SAN topologies, SAN over Ethernet architectures, such as iSCSI , FCoE. Virtualization at the host, storage target and Fabric-Based Virtualization

COURSE OBJECTIVE(S)

The objective of this course is:

1. To introduce the mathematical basics of speech modeling, and its applications.
2. To understand the various applications of speech modeling
3. To comprehend the computational concepts learned in the lecture classes through numerical simulations and programming
4. To help the students extend their understanding of signal processing algorithms for speech processing.
5. To strengthen the research skills of students in speech processing.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify key challenges in managing information and analyze different storage networking technologies	1,2	1, 2
CO2	Understand components and the implementation of different storage networking technologies	1, 2,	2, 3
CO3	Analyze storage area network architecture and types of archives and forms of virtualization	1, 2, 4	2, 3
CO4	Illustrate the storage virtualization concepts at different levels	1, 2, 3	3
CO5	Develop an insight into the working of the storage network algorithms used for storage virtualization	1, 2, 3, 12	3
CO6	Develop solutions to the complex problems of storage virtualization, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√				
CO3			√	√		
CO4			√	√		
CO5			√		√	
CO6				√		

COURSE ARTICULATION MATRIX

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2											2	2	
CO2	2	2												2	2
CO3	2	3		3										2	2
CO4	3	2	3												3
CO5	3	2	3									3			3
CO6					3				3	3					3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT 1
Introduction to Information Storage and Intelligent Storage Systems: Evolution of Storage Architecture Data Center Infrastructure Virtualization and Cloud Computing Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems
UNIT 2
Fibre Channel Storage Area Networks and IP SAN: Fibre Channel, The SAN and Its Evolution, Components of FC SAN, FC Connectivity , Switched Fabric Ports, Fibre Channel Architecture , Zoning FC SAN Topologies , Virtualization in SAN iSCSI

UNIT 3
FCoE : FCIP, FCoE , General-Purpose Servers versus NAS Devices , Benefits of NAS , File Systems and Network File Sharing , Components of NAS , NAS I/O Operation , NAS Implementations, NAS File-Sharing Protocols , Factors Affecting NAS Performance
UNIT 4
Virtualization at the Host: Logical Volume Management, Storage Metadata Servers , Server-Based Storage APIs, **Virtualization at the Storage Target:** Array-Based Virtualization, Array-Based Data Replication, Array-Based Point-in-Time Copy (Snapshot), Distributed Modular Array Virtualization, **Fabric-Based Virtualization:** Sentient SANs, Techniques for Switch-Based Virtualization, The Fabric Application Interface Standard (FAIS)

TEXTBOOKS:

1. Information Storage and Management,Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839
2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

REFERENCE BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
2. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003

JOURNALS/MAGAZINES

1. Journal of Network and Systems Management-Springer
2. Future Generation Computer System- Science Direct.

SWAYAM/NPTEL/MOOCs

1. http://www.virtualnuggets.com/emcs--storage-area-network.html
2. https://www.udemy.com/course/storageintro/
3. https://www.ibm.com/training/course/SN71G

SELF-LEARNING EXERCISES:

Case study, Assignments, MOOC / Coursera/Conference

Course Title	Natural Language Processing in AI (PE-IV)				Course Type		Theory	
Course Code	B20EJS610	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW

The intent of the course is to give introduction to Natural Language Processing (NLP, a.k.a. computational linguistics), the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks as listed in the course syllabus, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical algorithms to acquire the knowledge needed to perform language processing.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of natural language processing and python.
2. Discuss how to access the text corpora and Lexical Resources.
3. Demonstrate the writing the structured programs to process the raw text.
4. Describe role of Classifiers in Text processing.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concepts of Python to implement NLTK tool to solve a given real world problem.	1 to 5	1,3
CO2	Develop an algorithm to access the text corpora and Lexical Resources to process the raw text.	1 to 5	2
CO3	Make use of Categorizing and Tagging concepts to solve the given real-world problems.	1 to 5	2,3
CO4	Analyze the performance of different classifiers in Text processing and Modelling Linguistic. Patterns	1 to 5	1

CO5	Learn new tools and technologies in the natural language processing and apply for suitable application development.	1 to 5, 12	1,2
CO6	Develop solutions in the language processing to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1 to 5, 9, 10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4				√		
CO5			√	√		
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2								3		3
CO2	2	3	2	3	3									3	
CO3	2	3	2	3	2									3	3
CO4	3	3	1	3	2								3		
CO5	2	2	2	2	2							3	3	3	
CO6	2	3	3	2	2				2	2				3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT-1

Language Processing and python, Accessing Text corpora and Lexical Analysis: Computing with language-Texts and words, a closer look at python: texts as list of words, **computing with language**: simple statistics, Automatic natural language understanding; Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet, Introduction to NLTK Tool.

UNIT-2

Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings.

UNIT-3

Categorizing and Tagging words: Using a Tagger, using a Tagger, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word.

UNIT-4

Classifying Text: Supervised Classification: Examples, Evaluation; Decision Trees, Naive Bayes Classifiers, Maximum Entropy Classifiers, Modelling Linguistic Patterns.

TEXT BOOKS:

1.Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, OReilly Media, 2009.

2.Yuxi (Hayden) Liu,"Python Machine Learning by Example," First edition, Packt publisher, 2017.

REFERENCE BOOKS:

1.James Allen, "Natural Language Understanding", Benjamin-Cummings Publishing Co., Inc. Redwood City, CA, USA,1995.

2.Christopher D. Manning and HinrichSchutze," Foundations of Statistical Natural Language Processing", The MIT Press, 1999.

3.Randolf Quirk, Sidney Greenbaum, Geoffrey Leech, Jan Svartvik, "A Comprehensive Grammar of English Language", Cambridge University Press,1987.

JOURNALS/MAGAZINES

1.ACM Transactions on Language Processing

2.Elsevier Journal of cognitive systems research

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105158/

2. https://nptel.ac.in/courses/106/106/106106211/

Self-Learning Exercises:

Extracting information from Text, Exploring the 20 Newsgroups with Text Analysis Algorithms, Stock Price prediction with Regression Algorithms,

Best Practices:

i) Data preparation stage

ii) Training sets generation stage

iii) Model training, evaluation and selection stage

<table>
<tr><td>course Title</td><td colspan="4">Full Stack Development (PE-IV)</td><td colspan="2">Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td>B20EQS612</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VI semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">13Hrs/ Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Full stack Developer covers concepts of the method of applying both front-end and back development protocols to develop websites. This course introduces the student to develop his own project or application. It also helps the student to understand the basics in CSS, JavaScript's, NODEjs, and MongoDB.

COURSE OBJECTIVE (S):

1. Introduction to basic concepts of Full Stack Web Development.
2. Explain the fundamentals of HTML, CSS, Bootstrap and its applications.
3. Introduction to Javascript & ReactJS.
4. Develop a new application using the front end stack.
5. Learn new tools and technologies in full stack development and apply for suitable application development.

6. Develop solutions in full stack to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the platform needed for full stack web development	1,2,3,9,12	3
CO2	Understand the Markup, CSS & BootStrap	1-5,9	3
CO3	Use the JavaScript to design a Web Application.	1-5,9,11	3
CO4	Understand the ReactJS Concepts.	1-5,9,11	3
CO5	Deploy the developed web application in real time scenarios.	1-5,9,12	2
CO6	Developer of the industrial software.	1-5,9,12	2

BLOOM'S LEVELOF THECOURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√	√			
CO3		√				√
CO4			√	√		√
CO5		√	√			
CO6				√		√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2						3			2	3	3	2
CO2	3	3	3	2	2				3						
CO3	3	3	3	2	3				3						
CO4	2	2	3	2	2				3						
CO5	3	3	3	1	3				2			3			
CO6	2	2	3	3	3				2			3			

Contents

UNIT-1
Full Stack Web Developer Introduction to Full Stack Web Developer, Front End Developer, Back End Developer, HTML Syntax and Semantics, CSS & Advanced CSS, Bootstrap.
UNIT-2
JavaScript JS Syntax, JS Comments, JS Variables, JS Let, JS Const, JS Operators, JS Data Types, JS Functions, JS Objects, JS Strings, JS String Methods, JS String Search, JS Array, JS Array Methods, JS Conditional Statement and JS Looping Statement.
UNIT-3
ReactJS Introduction to ReactJS, ECMAScript 6, React Render HTML, React JSX, React Components – Class Component, React Prop, React Events, React Condition, React Forms, React Hooks.
UNIT-4
Real Time Deployment Of Web Application Deploy Web Applications on server or cloud, Configuring the Server for application, Deploying database on server and Establishing connection with database, Synchronies database with deployed Application.

Text Books:

1. "Learning Web Design : A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Niederst Robbins
2. JavaScript: JavaScript For Beginners - Learn JavaScript Programming with ease in HALF THE TIME by Stephen Blumenthal
3. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux by Kirupa Chinnathambi

REFERENCE BOOKS:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-littlemongodb-book
2. W3schools - https://www.w3schools.com/REACT/default.asp.
3. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
4. https://aws.amazon.com/education/awseducate/
5. http://packaging.ubuntu.com/html/packaging-new-software.html
6. http://www.pyinstaller.org/ 6. https://pypi.org/project/py2exe/0.9.2.0/

JOURNALS/MAGAZINES:

1. https://vitamintalent.com/
2. https://www.ijert.org/the-new-era-of-full-stack-development

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Course Title	DATA MINING(OE-II)				Course Type		Theory	
Course Code	B20CIO601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Data mining is a major area of exploration for knowledge discovery in databases. Data mining is for relatively unstructured data for which more sophisticated techniques are needed. The course aims to cover powerful data mining techniques including clustering, classification and association rules**.**

COURSE OBJECTIVE

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Describe the classification algorithms for data categorization
4. Illustrate the clustering algorithms for grouping data sets
5. Demonstrate the appropriate data mining techniques for decision making
6. Analyze solutions using data mining algorithms to the complex problems, either individually or as a part of the team and report the results with proper interpretation.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of data mining techniques, data types, identify the similarity and dissimilarity between the data sets and analyze the data sets using the association rules and algorithms	1-5	1,2
CO2	Characterize and discriminate data sets with classification methods	2,3,5,7,8	2
CO3	Employ the clustering methods in real life problems	1-7	2,3
CO4	Apply the knowledge for data mining applications	1-7,11-12	2,3
CO5	Demonstrate the appropriate data mining techniques for decision making	1, 11	2
CO6	Analyze solutions using data mining algorithms to the complex problems, either individually or as a part of the team and report the results with proper interpretation.	1-5	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√		√		
CO3			√	√		
CO4		√	√	√	√	
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	2	1	3	1								1	3	
CO2		1	2		1		3	1						2	
CO3	2	2	1	2	3	1	2							1	3
CO4	2	2	1	2	3	1	2				1	3		1	2
CO5	2	2									2			2	2
CO6	2	3									3			2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents

UNIT-1
Introduction: What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization.
UNIT-2
Association Analysis: Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP GROWTH Algorithm, Evaluation of Association Patterns .
UNIT-3
Classification: Basics, General approach to solve classification problem, Decision Trees, Evaluating the performance of a Classifier, Rule Based Classifiers, Nearest Neighbour Classifiers, Naïve Bayes Classifier
UNIT-4
Clustering: overview, K-means**,** agglomerative hierarchical clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters and Clustering Algorithms, Prototype Based Clustering.

TEXTBOOKS:

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2007.

2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.

REFERENCE BOOKS:

1. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

2. G.K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

JOURNALS/MAGAZINES:

1. Data Mining and Knowledge Science – Springer.
2. Interscience, the International Journal of DataMining, Modelling and Management-
3. IEEE, IEEE Transactions on Knowledge and Data Engineering.

SWAYAM/NPTEL/MOOCS:

1. https://nptel.ac.in/courses/110/107/110107129/
2. https://onlinecourses.nptel.ac.in/noc19_mg47/preview
3. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview

SELF LEARNING EXERCISES:

1. https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing
2. https://www.coursera.org/learn/text-mining
3. https://www.ibm.com/cloud/learn/text-mining

Course Title	Machine Learning (OE-II)				Course Type		Theory	
Course Code	B20CIO602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 week / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain machine learning and problems relevant to machine learning.
2. Discuss the fundamentals of Decision trees learning and its issues.
3. Illustrate neural networks , Bayes classifier and k nearest neighbour for problems appearing in machine learning.
4. Describe statistical analysis of machine learning techniques.
5. Learn new techniques in Machine learning and apply for suitable application development.
6. Analyse solutions in the machine learning to the complex problems, either individually or as part of the team and report the results with proper analysis and interpretation

COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design the learning system to provide the solution for the given problem.	1 to 5	1,2,3
CO2	Apply Decision Tree technique for Classification problem	1 to 5	1,2,3
CO3	Develop Recognition or Prediction systems using Neural Network/Bayesian Model	1 to 5	1,2,3
CO4	Solve the problem by hypothesis testing using probability and statistics.	1-5	1,2,3

CO5	Learn new techniques in Machine learning and apply for suitable application development.	1-5	1,2,3
CO6	Analyse solutions and apply machine learning techniques to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1-5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√				
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3
CO4	3	2	2	2	2								3	3	3
CO5	3	2	3	1	1								3	3	3
CO6	3	2	3	2	2				3				3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

THEORY

Contents
Unit-1: **Introduction to Machine Learning:** What is Machine Learning, challenges, Applications, methods of Machine Learning, performance metrics, Data preprocessing, Data Loading, Understanding data, Pre-Processing unit
Unit-2: **Classification** – Decision Tree, K-nearest neighbor, logistic regression, support vector machine algorithm, naive Bayes algorithm, random forest algorithm
Unit -3: **Regression** - linear regression, Random Forest Regression **Clustering:** overview, k – means clustering, mean shift clustering, hierarchical clustering, DBSCAN clustering algorithm.
Unit – 4 **Introduction to neural networks:** Biological Neuron, ANN Perception, Network Topology (Feed forward network, Feedback Networks), Adjustments of Weights or Learning, Activation Functions, Training Algorithm, Gradient descent algorithms -Batch Gradient Descent, Stochastic Gradient Descent, Mini Batch gradient descent.

TEXT BOOK:

Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education,2013.

Websites:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.tutorialspoint.com/artificial_neural_network/index.htm

REFERENCE BOOKS:

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd edition, springer series in statistics, 2009.
4. Ethem Alpaydın, "Introduction to machine learning", second edition, MIT press, 2009.

JOURNALS/MAGAZINES:

3. Springer Journal of Machine Learning.
4. International Journal of Machine Learning and Computing.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Machine Learning

2.Coursera – Deep Learning

3. https://onlinecourses.nptel.ac.in/noc19_cs53/previe

SELF-LEARNING EXERCISES:

Reinforcement Learning: Introduction, Learning Task, Q Learning.

Website to be referred:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.tutorialspoint.com/artificial_neural_network/index.htm

Course Title	Neural Networks (OE-II)				Course Type		Theory	
Course Code	B20CIO603	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 week / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: This course introduces the basic learning models, learning algorithms, and some applications of neural networks. The focus is on to understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, etc.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand mathematical basics of neural networks.
2. Choose appropriate error function and optimization algorithm
3. Enable a student to train a neural network using suitable approach
4. Design real world solutions using Neural networks.
5. understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization.

COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the mathematical concepts behind working of neural networks.	1-5	1

CO2	Illustrate the error functions and optimization algorithms that can be applied to a neural network model	1-5	2
CO3	Demonstrate the training of a neural network model to solve a problem.	1-5	3
CO4	Design a neural network using Tensor Flow to solve a real world problem.	1-5	3
CO5	Understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization.	1-5,9	3
CO6	Analyse solutions using pattern recognition to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1,2,5,11	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√	√			
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	1	2										3

CO4	3	2	2	2	2										3
CO5	3	3	3	2	2										3
CO6	3	3	3	3	3					2	2				3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:
THEORY

Contents
UNIT-1
Neural Network Basics – Statistical Pattern Recognition – an example character recognition, classification and regression, pre-processing and feature extractions, polynomial curve fitting, multivariate non-linear functions, decision boundaries, minimizing risk, single layer networks – linear discriminant functions, linear separability, least squares techniques, the perceptron, multi-layer perceptron – feed forward network mappings, threshold units, sigmoidal units, error back propagation, Jacobian Matric, Hessian matrix.

UNIT-2
Learning and Generalization: Error Functions and Parameter Optimization Algorithms –Sum of squares error, Minkowski error, input dependent variance, modelling conditional distributions, estimating posterior probabilities, sum of squares for classification, cross entropy for two classes, entropy. Error Surfaces, Local quadratic approximation, linear output units, optimization in practice, gradient descent, conjugate gradients, Newton's Method, Bias and Variance, Regularization, Training with noise, soft weight sharing, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers, Looking Forward.
UNIT-3
Training Feed-Forward Neural Networks: The Fast-Food Problem, Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Back-propagation Algorithm, Stochastic and Mini batch Gradient Descent, Test Sets, Validation Sets, and Over fitting, Preventing Over fitting in Deep Neural Networks. Back Propagation: The Back propagation Network, The Generalized Delta Rule, Practical Considerations, BPN Applications, The Back propagation Simulator.
UNIT-4
Implementing Neural Networks in Tensor Flow: Definition of Tensor Flow, Installing Tensor Flow, Creating and Manipulating Tensor Flow Variables, Tensor Flow Operations, Placeholder Tensors ,Sessions in Tensor Flow, Navigating Variable Scopes and Sharing Variables, Managing Models over the CPU and GPU, Specifying the Logistic Regression Model in Tensor Flow, Logging and Training the Logistic Regression Model, Leveraging Tensor Board to Visualize Computation Graphs and Learning, Building a Multilayer Model for MNIST in Tensor Flow.

TEXT BOOKS:

1. Christopher M Bishop, “Neural Networks for Pattern Recognition”, Clarendon Press, Oxford, 2005.
2. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning, designing next-generation machine intelligence
algorithms”, O’Reilly, 1st Edition.

REFERENCE BOOKS:

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.
3. Neural Networks Algorithms, Applications, and Programming Techniques - James A. Freeman

JOURNALS/MAGAZINES

1. IEEE Transactions on Neural Networks and learning systems
2. IEEE Transactions on Evolutionary Computation
3. IEEE Transactions on Fuzzy systems
4. Journal of Applied Soft Computing –Elsevier

SWAYAM/NPTEL/MOOCs:

1. www.cs.stir.ac.uk/courses/ITNP4B/lectures/kms/1-Intro.pdf
2. https://www.nptel.ac.in/courses/106/106/106106184

SELF-LEARNING EXERCISES:

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis.

Course Title	Information and Network Security Lab				Course Type		Practice	
Course Code	B20EJ0603	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

COURSE OVERVIEW:

Course Description: The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices in Intrusion Detection Systems	1 to 5	1
CO2	Make use of the different cryptographic algorithms for encryption and decryption of given data.	1 to 5	2
CO3	Compare the various performance of protocols used for authentication.	1 to 5	2,3
CO4	Identify security in different layers of OSI for solving real world network problems	1 to 5	1
CO5	Relate different firewalls available for more security	1 to 5	2,3

CO6	Identify different auditing tools for intrusion management system.	1 to 5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√	√		
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	2	3									3	3
CO4	2	2	2	1	1									3	3
CO5	2	2	3	3	1									2	3
CO6	2	2	3	3	2									2	3

Note: 1-Low, 2-Medium, 3-High

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Study the tool used for Network scanning ie NMAP and conduct the network analysis.	Any Tool for Scanning	Computer Networks, C/C++/Java/python
2.	Setup a honey pot and monitor the honeypot on network (KF Sensor).	Honey Pot	Computer Networks, C/C++/Java/python
3.	Implement Caesar cipher using suitable programming and show the successful decryption of Ciphertext and verify the same with "Cryptool".	Cryptool	Computer Networks, C/C++/Java/python
4.	Implement DES algorithm to encrypt the data and verify the same with 'Cyptool'.	Cryptool'	Computer Networks, C/C++/Java/python
5.	Implement a simple RSA algorithm and demonstrate how to recover the Plaintext.	RSA algorithm	Computer Networks, C/C++/Java/python
6.	Demonstrate how to perform key exchange securely using Diffie Helman Keyexchange mechanism.	Diffie Helman Keyexchange mechanism.	Computer Networks, C/C++/Java/python
7.	Demonstrate the data hiding using any steganography tools.	Any Steganography Tools	Computer Networks, C/C++/Java/python
8.	Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.	Snort	Computer Networks, C/C++/Java/python
9.	Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool.	Penetration Tools	Computer Networks, C/C++/Java/python
10.	Install the Tinywall and configure it. Inspect the incoming and outgoing packets. Prepare the report of the Firewall traffic analysis.	Tiny wall	Computer Networks, C/C++/Java/python

Course Title	Information Retrieval Systems Lab				Course Type		Practice	
Course Code	B20EQ0602	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	1	2	2	0	26	50%	50%

COURSE OVERVIEW:

Information retrieval is the process through which a computer system can respond to a user's query for text-based information on a specific topic. IR was one of the first and remains one of the most important problems in the domain of natural language processing (NLP). Web search is the application of information retrieval techniques to the largest corpus of text anywhere -- the web -- and it is the area in which most people interact with IR systems most frequently.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the basic concepts of the information retrieval and its models.
2. Illustrate the use of query languages and its operations in real world applications
3. Demonstrate the use of user interfaces and visualization for search process
4. Explain the multimedia IR models, Indexing and searching the web concepts.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline basic concepts of the information retrieval.	1 to5	2
CO2	Apply appropriate Query technique on given real world applications	1 to5	2
CO3	Develop user interfaces and visualization for search process to address research issues.	1 to5	2
CO4	Identify appropriate indexing and searching method for Feature Extraction.	1 to5	2

CO5	Demonstratetheuseofuserinterfacesandvisualizationforsearchprcess	1 to5	2
CO6	Explain the multimedia IR models, Indexing and searching the web concepts	1 to5	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√				
CO2			√			
CO3						√
CO4				√	√	
CO5		√		√		
CO6		√				

COURSE ARTICULATION MATRIX:

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1										3
CO2	2	3	2	1	2										3
CO3	2	2	2	2	1										3
CO4	2	2	3	1	2										3
CO5	2	3	2	1	2										3
CO6	2	2	2	2	1										3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

PRACTICE

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Demonstrate simple term weights computation for the given query.	The search index must be supported by Lucene (although, there are other more research-oriented search engines). The project implementation can be in either Java (better search engine support) or **Python** (better text pre-processing support).	To quantify words in a set of documents
2.	Implement hands-on experience store, and retrieve information from www using semantic approaches.	Semantic search	To improve search accuracy by understanding the content of the search query.
3.	Implement the usage of different data/file structures in building computational search engines.	Membership Operators Linear Search Binary Search Jump Search Fibonacci Search Exponential Search Interpolation Search	To Use different data/file structures in building computational search engines
4.	Implement the Analysis and the performance of information retrieval using various classification algorithm on text	Text Classification using scikit-learn, python and NLTK.	To Analyse the performance of information retrieval using various classification algorithm on text
5.	Implement the Analysis and the performance of information retrieval using Clustering algorithm on text	Clustering text documents using k-means	To the Analysis and the performance of information retrieval using Clustering

6.	Implement Domain specific Search Engine	The Domain Specific Search Engine is specific towards "Mobile Phone Related Document Searches". It is designed into three basic parts: Corpus collection: Creating Inverted Index:	To design a Domain Specific Search Engine
7.	Implement how to Analyse ranked retrieval of a very large number of documents with hyperlinks between them	Hyperlink Induced Topic Search	To Analyse ranked retrieval of a very large
8.	Implement how N-grams are used for detection and correction of spelling errors.	Text Blob(offline) / Google Colab (Online)	To generate any number of n-grams for a given text dataset easily in Python and thus analyse our dataset
9.	Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.	Preparing the documents Create a Term-Document Matrix with TF-IDF weighting Calculate the similarities between query and documents using Cosine Similarity Retrieve the articles that have the highest similarity on it.	To build a simple search engine from scratch using Python and its supporting library
10.	Implement one of the case studies of Information Retrieval System	PyTerrier & Kaggle Dataset	To analyze the case studies of IRS and implement using Python

Web Resources:

https://www.youtube.com/watch?v=q0srNT_XM_Y&list=PL0ZVw5-GryEkGAQT7lX7oIHqyDPeUyOMQ

https://towardsdatascience.com/tf-idf-for-document-ranking-from-scratch-in-python-on-real-world-dataset-796d339a4089

https://www.youtube.com/watch?v=yluvahNq3wk

https://scikit-learn.org/stable/auto_examples/text/plot_document_clustering.html

https://analyticsindiamag.com/guide-to-pyterrier-a-python-framework-for-information-retrieval/

https://towardsdatascience.com/create-a-simple-search-engine-using-python-412587619ff5

https://github.com/ayushjain19/Domain_Specific_Search_Engine

https://medium.com/mlearning-ai/semantic-search-with-s-bert-is-all-you-need-951bc710e160

https://stackabuse.com/search-algorithms-in-python/

https://towardsdatascience.com/machine-learning-nlp-text-classification-using-scikit-learn-python-and-nltk-c52b92a7c73a

https://www.analyticsvidhya.com/blog/2021/09/what-are-n-grams-and-how-to-implement-them-in-python/

https://stackabuse.com/spelling-correction-in-python-with-textblob/

Other useful references

Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.

Information Retrieval: Algorithms and Heuristics, by D. Grossman and O. Frieder.

Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.

Search Engines: Information Retrieval in Practice, by B. Croft, D. Metzler, and T. Strohman.

Information Retrieval: Implementing and Evaluating Search Engines, by S. Büttcher, C. Clarke, and G. Cormack.

Course Title	RESEARCH BASED MINI PROJECT				Course Type		Practice	
Course Code	B20CI0601	Credits	2		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	2	4	4	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**4**	**4**	**0**	**52**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. This course introduces problem selection, synopsis writing, ethics, research design skills, research methods, how to carry out literature survey, reading and writing technical paper, thesis writing, introduction latex and beamer and how to design the quality research proposal.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the dimensions and methods of research.
2. Illustrate the design of informed choice from the large number of alternative methods and experimental designs available.
3. Describe the features of a good research proposal.
4. Discuss the skills required for undertaking a research project and preparing a technical paper.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the dimensions and methods of research for solving real world problems.	1,4,7,11,12	2,3
CO2	Identify the appropriate research problem and parameters to carry out the research work.	2,5,6,12	2,3
CO3	Apply different research skills in preparing proposal for research project and technical paper.	6,7,11	2,3
CO4	Create IPR documents using Latex Tool.	3,12	3
CO5	Learn new tools and technologies in research methodologies and apply for suitable application development.	1-5	2
CO6	Analyse solutions using Research Methodologies to the complex problems either individually or as a part of the team and report the results with proper analysis and interpretation	5,11	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√	√	
CO3			√			
CO4						√
CO5		√				
CO6			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			2			1				1	1	1	2	
CO2		2			1	3						2	2	2	
CO3						2	1				2		2	1	
CO4			2									2			3
CO5	2	3		2	2						2				3
CO6	2	3		2	2						2				3

Note: 1-Low, 2-Medium, 3-High

A Mini Project has to be carried out by the students and the same has to be completed by the end of semester. Students have to spend a minimum of 8 hours per week on the mini project. A Mini Project has to be developed and documented using Latex. The outcome of the mini project should be paper publication/ IPR

Course Title	INDIAN TRADITION & CULTURE				Course Type		Theory	
Course Code	B20PA0501	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**1**	**1**	**13**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course offers the students with various aspects of culture and heritage of India..This course also enable the students to understand the contribution of our ancestors in the areas of science, medicine, arts, language and literature.

COURSE OBJECTIVE:

The objectives of this course is to:

1. To provide conceptual knowledge of Indian culture and traditions
2. To introduce students to the science and technological advancements related to Indian culture
3. To help students understand the Indian spiritual aspects of Indian culture
4. To help learners understand the factors which unite the diverse cultures of India

COURSE OUTCOMES (COs)

1. Gain conceptual understanding of Indian culture and traditions.
2. Describe various ancient theories in treatment of any disease, Appreciate the science and technological advancements in ancient India.
3. Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.
4. Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food and Understand India as a land united by cultural diversity.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Gain conceptual understanding of Indian culture and traditions.	2,3,4,6,8,12	3
CO2	Describe various ancient theories in treatment of any disease, Appreciate the science and technological advancements in ancient India.	10,11	3
CO3	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.	11	3
CO4	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food and Understand India as a land united by cultural diversity	11,12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√	√			
CO3		√				
CO4		√				

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1	2		2		3				3			1
CO2										2	2				2
CO3											2				1
CO4											2	2			1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Indian Tradition i. Culture – Indus Valley Civilization and early cultural practices, The Vedic culture, Influence of Buddhism and Jainism on Indian Culture, Influence of Islam and Christianity, Indian Cultural Renaissance of the 19th Century ii. Religion – Pre-vedic and Vedic religion, Jainism, Buddhism, Hinduism, Religious Reform Movements, Advent of Christianity iii. Art – Introduction to Natyashastra, classical and contemporary art forms (dance and music), regional art forms (dance and music), Folk art, puppetry iv. Architecture – Engineering and Architecture in Ancient India; Evolution of Hindu Temple Structures, Sculptures, Coins and Pottery from Ancient India v. Literature- Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.

UNIT-2
Contribution of ancient India to Science and Maths i. Development of Science in Ancient India- Astronomy, Mathematics, Medicine, Metallurgy. ii. Scientists of Ancient India: a. Mathematics and Astronomy- Baudhayan, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya b. Science- Kanad, Varahamihira, Nagarjuna c. Medical Sciences (Ayurveda and Yoga)- Susruta, Charaka, Yoga and Patanjali iii. Science and Scientists in Medieval India- Mathematics, Biology, Chemistry, Astronomy, Medicine, Agriculture. iv. Scientists in Modern India- Srinivas Ramanujan, Chandrasekhara V Raman, Jagadish Chandra Bose, Homi Jehangir Bhabha, Dr, Vikram Ambalal Sarabhai, ,Dr. APJ Abdul Kalam
UNIT-3
Indian Spiritual Aspects I. Hindu Spirituality based on shruti and smriti- Hinduism in General, Basic notions of Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita. ii. Hata Yoga and Pranayama- Main Features, Basics of Yoga –Different kinds of Yoga; Raja Yoga (Ashtanga yoga); Karma yoga; Bhakti Yoga – yoga of Loving Devotion; Jnana yoga – Yoga of Knowledge; Hatha Yoga (Asana/ Pranayamas); Kundalini Yoga; Nada Yoga; Sannyasa Yoga iii. Buddhist, Jaina Spiritualities- Main Doctrines of Buddhism: Four Noble Truths (Arya Satya), Concept of Nirvana - Ashtanga Marga
UNIT-4
Unity in Diversity i. Commensality and the Significance of Food – Eating Together as Family and as a Society, Food at Rituals; annaprasan, marriage and funeral, Kitchen as Shared Space for Women, Food and Nationalist Response of Indian Community, Visibility of Indian Cuisine in the World ii. Celebrating Diverse Festivals – Festival Types: Religious and Seasonal, Religious - Holi, Diwali, Ganesh Chaturthi, Janmashtami, Mahavir Jayanthi, Ramadan, Christmas, Buddha Purnima; Seasonal (harvest festivals) - Baisakhi, Pongal, Sankranti iii. Attire - Indus Valley Civilization, Vedic period, Modern India

TEXT BOOKS:

1. Sundararajan K.R., Hindu Spirituality - Vedas through Vedanta, Cross Road Publications, New York, 1997.

2. Griffiths Bede, Yoga and the Jesus Prayer Tradition, Asian Trading Corporation, Bangalore, 1992

REFERENCE BOOKS:

1. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998

2. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.

3. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018

JOURNALS/MAGAZINES

1. Arts and Humanities (miscellaneous)

2. History

3. Language and Linguistics

4. History and Philosophy of Science

5. Literature and Literary Theory

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/109/103/109103018/

Course Title	MODERN DATABASE				Course Type		Theory	
Course Code	B20EQ0603	Credits	2		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**3**	**3**	**13**	**26**	**50**	**50**

COURSE OVERVIEW

This course will provide students with a general overview of databases, introducing you to database history, modern database systems, the different models used to design a database, and Structured Query Language (SQL), which is the standard language used to access and manipulate databases. Effective collection, analysis, and maintenance of data is key to achieve rapid progress in almost all disciplines of science and engineering.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the concepts of DBMS and SQL
2. Discuss the Object oriented concepts and object relational Databases
3. Demonstrate the use of parallel and distributed databases in real world applications
4. Illustrate the development of Enhanced Data Model for given applications
5. Utilize a wide range of features available in a DBMS package.
6. Analyse database requirements and determine the entities involved in the system and their relationship to one another.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of DBMS and SQL in real world applications	1 to 4, 8, 9 , 12	1
CO2	Develop programs for Make use of the Object oriented concepts and object relational databases in real world applications.	1 to 3, 5,9,12	1
CO3	Apply features of Experiment with parallel and distributed databases.	1 to 5, 9, 12	2
CO4	Create enhanced Data Model for given applications	1,4,5,9,12	1

CO5	Utilize a wide range of features available in a DBMS package.	1,4,5,9,12	1
CO6	Analyse database requirements and determine the entities involved in the system and their relationship to one another.	1,4,5,9,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			√
CO2			√			√
CO3			√	√		
CO4			√	√	√	
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2									3		
CO2	2	2	3		2									3	
CO3	3	1	2	1	2										3
CO4	3			2	2								3	3	3
CO5	3			2	2								3	3	3
CO6	3			2	2								3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents
UNIT-1
Overview of DBMS and SQL: Introduction to DBMS and SQL, SQL Data Definition and Data Types, Schema change statements in SQL, Specifying basic constraints in SQL, Basic Queries in SQL, More Complex Queries in SQL.
UNIT-2

Modern database: General Constraints as Assertions, Views in SQL, Database Programming, Embedded SQL. Introduction to Hadoop, NoSQL, New SQL, MongoDB, Amazon RDS, Oracle & other latest technologies.
UNIT-3
Overview of Object-Oriented Concepts: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL
UNIT-4
Object and Object-Relational Databases: Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	a) **Product - Order System:** In recent years, most of the grocery items are available online; hence people are doing online transactions for purchase. There are lot of discounts and benefits through the online orders. Since everyone in the life is busy with one or other works, such applications will save their time. These online transaction based applications require many databases to be built for storage and transaction management. Design a product-order database which can store the details of customers, agents and the products. All the details of sold products along with commission from different agents across different cities will get stored in this database and utilized for transactions. **To create DDL commands:** Customer (cid, cname, city, discount) Agent (aid, aname, city, commission) Product (pid, pname, city, quantity, price) Orders (ordno, month, cid, aid, pid, qty, amount)	SQL / Oracle-	Create and perform operations.

		SQL / Oracle	Create and perform operations on Tuples.
	b) To practice with the following DML Commands: **a) Insert** **b) Delete** **c) Modify** **d) Select**	SQL / Oracle	To perform the operations.

	a) Queries a. Retrieve the customer ids of any product which has been ordered by agent "a06". b. Retrieve cities in which customers or agents located. c. List product ids which have been ordered by agents from the cities “Dargeling” or “Srinagar”. d. Retrieve customer ids whose discounts are less than the maximum discount. e. Retrieve product ids ordered by at least two customers. f. For each (aid, pid) pair get the sum of the orders aid has placed for pid. g. Retrieve product ids and total quantity ordered for each product when the total exceeds 1000. h. List the names of the customers and agent who placed an order through that agent. i. Retrieve order numbers placed by customers in "Dargeling" through agents in "New Delhi". j. Retrieve names of the customers who have the same discount as that of any (one) of the customers in "Dargeling" or "Bangalore".		Create and perform operations.
2.	b) **Queries:** k. Retrieve customer ids with smaller discounts than every customer from " Srinagar” l. Retrieve names of the customers who have placed an order through agent "a05". (using exists) m. Retrieve names of the customers who do not place orders through agent "a05". (using not exists) n. Retrieve customer ids whose orders placed through all the agents in "New Delhi". o. Retrieve agent ids either from "New Delhi" or "Srinagar" who place orders for ALL products priced over one dollar. p. Retrieve names and ids of the customers and agents along with total dollar sales for that pair. Order the result from largest to smallest total sales. Also retain only those pairs for which total dollar sales is at least 9000.00. q. Increase the percent commission by 50% for all agents in "New York". r. Retrieve the total quantity that has been placed for each product.	SQL / Oracle	Create and perform operations

3.	a) **Employee Database System** The storage of digital data is increasing day by day. Every big / small organization started storing their Employee details like name, salary, address, Department under which they are working in their own database. Design a company database which can store the details of Departments, projects, their Employee and his / her dependent details of a particular organization. To create DDL command for the following: **Employee** (ssn, name, salary, sex, super_ssn, address, dno) **Department** (dname, dnumber,mgr_ssn) **Dept_Loc** (dnumber, dloc) **Project** (pname, pnumber, plocation, dnum) **Works_On** (essn, pno, hours) **Dependent** (essn, depen_name, address, relationship, sex) b) **Queries** a. Retrieve the names of the Employees who works on all the projects controlled by dept no 3. b. Retrieve the names of the Employees who gets second highest salary. c. Retrieve the names of the Employees who have no dependents in alphabetical order. d. List the names of all Employees with at least two dependents. e. Retrieve the number of Employees and their average salary working in each Department. f. Retrieve the highest salary paid in each Department in descending order. g. Retrieve the SSN of all Employees who work on at least one of the project numbers 1, 2, 3. h. Retrieve the number of dependents for an Employee named RAM. i. Retrieve the names of the managers working in location named xyz who has no female dependents. j. Retrieve the names of the Employees who works in the same Department as that of RAM.	SQL / SQL Server	Create and perform operations
4.	a).Consider the text file, “Std.txt”, with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, “Std.txt” and display the details of all the students of 4th Semester “ A” Section who have scored more than 75%.	MongoDB	Create and perform operations

	b).Consider the text file "Emp.txt", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following: i) TOTAL_DEDUCTIONS= (LIC+PF) ii) GROSS_SALARY= BASIC_SALARY+ DA iii) NET_SALARY= GROSS_SALARY – TOTAL_DEDUCTIONS. Write the above data to file for each employee. Read the content of "Emp.txt" and display the details of each employee		Create and perform operations
5.	a). A "CAR" has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACUTING_YEAR and PRICE. A Class is required to be created for "CAR" to store the above attributes and perform the following operations: i) Get the details of "CAR" object from user and store into Array of objects ii) Display the details of "CAR" object based on "COMPANY", "MODEL" and "PRICE".	MongoDB	Create and perform operations
	b). **Airline Reservation System**: It contains the attributes of passengers such as NAME, PAN_NO. MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for "Airlilne" with the above attributes and perform the following operations: i) Get the details of "Airline" object from user and store into Array of objects ii) List details of all the passengers who travelled From "Bengaluru to London". iii) List details of all the passengers who travelled From "Chicago to Beijing" on 10th of Feb, 2020.		
6.	iv) a). "Arr_1" is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the i) Diagonal elements of "Arr_1" ii) Elements of mth row (row no should be entered by user) iii) Elements of nth column (column no should be entered by user)		Create and perform operations
	b).The dictionary "DICT1" contains the pass percentage of each semester of B. Tech in CSE, where, " Semester" acts as the key and "Pass Percentage" acts as the value. A Python Pandas dataframe is required to be created using the dictionary "DICT1" and display it using a user defined function.		Create and perform operations

	Part-B (Mini Project: Library Management System)		
1.	Develop a program to create the class "USER" with the attributes USER_NAME, USER_ID, SCHOOL_NAME, ADDRESS, PHONE_NO, EMAIL_ID, DOB and AGE. The functions add_user(), delete_user(), edit_user(), search_user() should be part of the class. Instantiate "User" class with 10 objects. Read the attributes of each "User" object using input() and store them in the file "User_File.txt".	MongoDB	Create a class user to read the attributes of user and store them in a file.
2	Develop a program to get the name of the "User" object whose details are to be deleted. Read the "User_File.txt" and delete the "User" object if found. Display the contents of "User_File.txt" after deletion.	MongoDB	Create a class user to read the attributes and delete the object.
3	Develop a program to get the name of the "User" object whose details are to be edited (modified). Edit the details of the user object in the file "User_File.txt" and display the contents after modification.	MongoDB	To create a class and edit the file.
4	Develop a program to create the class "BOOK" with the attributes TITLE, AUTHOR, PUBLISHER, YEAR, PRICE, SCHOOL_NAME and the functions add_book(), delete_book(), edit_book() and search_book(). Instantiate "Book" class with 10 objects. Read the attributes of each "BOOK" object using input () and store them in the file "Book_File.txt".	MongoDB	Create a class book to read the attributes of user and store them in a file.
5	Develop a program to get the name of the "BOOK" object whose details are to be deleted. Read the "Book_File.txt" and delete the "BOOK" object whose details match with the data entered. Display the contents of "Book_File.txt" after deletion.	MongoDB	Create a class book to read the attributes and delete the object.
6	Develop a program to get the name of the "BOOK" object whose details are to be edited (modified). Edit the details of the "Book" object in the file "Book_File.txt" and display the contents after modification.	MongoDB	To create a class and edit the file.

7	Develop a program to create the class "TRANSACTION" with the attributes USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE,DUE_DATE and RETURN_DATE and the functions issue_book(), return_book() and search_book(). Instantiate "Transaction" class with 10 objects. Read the attributes of each "Transaction" object using input() and store them in the file "TransactionFile.txt". Develop a program to issue the book as requested by the user. Update the attributes in "Transaction _File" and display the contents of file.	MongoDB	Create class and perform string operations.
8	Develop a program to return the book. Edit the details of the user like USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE in "TransactionFile.txt" and display the contents after modification. Compute the fine amount to be paid if return_date is not same as due_date. If both return_date and due_date are same and put zero in fine_amount.	MongoDB	Create class and perform string operation.
9	Develop a program to search for a book using its "author". Display the message "available" if search is successful otherwise display the message "not available".	MongoDB	Create class and object, perform file operations and regular expressions.
10	Develop a program to get a list of users by referring to "User_File.txt" and "Transaction_File.txt".	MongoDB	Create class and object, perform file operations and regular
11	Develop a program to get List of Books in stock by referring to "Book_File.txt" and "Transaction_File.txt".	MongoDB	Create class and object, perform file operations and regular expressions.
12	Develop a program to get List of Books Issued by referring to "User_File", "Book_File" and "Transaction_File".	MongoDB	Create class and object, perform file operations and regular expressions.
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	MongoDB	Module integration and project development.

TEXT BOOKS

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw- Hill, 2003.

2. Elmasri and Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.
2. C J Date, Database Design and Relational Theory: Normal Forms and All that Jazz, O 'Reilly, April 2012.

3. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier, 2011.
4. Connolly and Begg, Database Systems, 4th Edition, Pearson Education, 2002.

JOURNALS/MAGAZINES

1. IEEE, IEEE Transactions on Knowledge and Data Engineering
2. Elsevier, Elsevier Data and Knowledge Engineering
3. ACM, ACM Transactions on Database Systems

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/courses?query=database
2. https://www.edx.org/learn/databases
3. https://academy.oracle.com/en/solutions-curriculum.html

SELF-LEARNING EXERCISES

1. Data warehousing, Data Marts, Getting data into the warehouse More exploration on GIThub
2. Data warehousing & KM , Data warehousing & CRM C modules interface

Detailed Syllabus
Semester -7

Course Title	MULTIMEDIA SYSTEMS (PE-V)				Course Type		Theory	
Course Code	B20EJS701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The course includes fundamental concepts of multimedia, Speech, Image and video processing including international standards, Fundamentals of multimedia data compression, standards and synchronization.

COURSE OBJECTIVE:

The objectives of this course are to:

1. Explain various multimedia components
2. Describe the different Lossy and Lossless compression techniques with respect to multimedia data
3. Discuss the different compression techniques for Image and video
4. Illustrate the use of synchronization concepts.

COURSE OUTCOMES (COs)

After the completion of the course, the stud678ent will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the multimedia Components required for developing real world applications	1 to 4, 9, 12	1
CO2	Choose a suitable Lossy and Lossless compression techniques for compressing the given multimedia data.	1 to 3,5,9,12	2
CO3	Design the applications using different compression techniques for Image and video	1 to 3,5,9, 12	3
CO4	Analyze the working of synchronization in multimedia data.	1 to 5, 9, 12	2,3
CO5	Design applications by applying multimedia software tools	1 to 5,9,12	2,3
CO6	Apply synchronization techniques to solve multimedia problems	1 to 5,9,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3			√			
CO4						√
CO5				√		
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2					2			2	3		
CO2	3	2	2		2				1			1		3	
CO3	3	1	1		2				1			1			3
CO4	3	2	2	2	2				2			2		3	3
CO5	3	2	2	3	1				1			2		3	3
CO6	3	2	2	2	2				2			2		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
UNIT-1
Introduction to Multimedia - What is Multimedia? Multimedia- Past and Present, Multimedia Software Tools- A Quick Scan **Graphics and Image Data Representations -** Graphics/Image Data Types, Popular File Formats,

Colour Models in Images
UNIT-2
Multimedia Data Compression - Lossless Compression Algorithms, Basics of Information Theory, Run-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. Lossy Compression Algorithms - Introduction, Distortion Measures, theRate-Distortion Theory, Quantization, Transform Coding.

UNIT-3
Image and Video Compressions - The JPEG Standard, the JPEG2000 Standard, the JPEG-LS Standard, Bi-level Image Compression Standards, Introduction to Video Compression, Video Compression Based on Motion Compensation, H.261, H.263, MPEG-1.
UNIT-4
Synchronization - Defining "Synchronization", Particularities of Synchronization in Multimedia Systems, Requirements to the Presentation, Reference Elements for Synchronization, Synchronization Types, System Components Involved in Synchronization, A Reference Model for Multimedia Synchronization, Synchronization Specification, Specification Methods for Multimedia Synchronization.

TEXT BOOKS:

l. Li, Ze-Nian, Drew, Mark S., Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, 20l4.

2. Steinmetz, Ralf, Nahrstedt, Klara, "Multimedia Systems" Springer, 2004

REFERENCE BOOKS:

1. Fred Halshall, "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson education, 2007.

2. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education. 2008.

3. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007.

4. Introduction to Multimedia Networks, Andrew W. Davis

5. Rao, Bojkovic, Milovanovic: Introduction to Multimedia Communications, Wiley & Sons, Hoboken, NJ, 2006

JOURNALS/MAGAZINES

1. IEEE Transactions on Multimedia , https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6046
2. ACM Transactions on Multimedia Computing, Communications, and Applications**,** https://dl.acm.org/journal/tomm
3. Elsevier Journal on Multimedia Computing , https://www.journals.elsevier.com/computer-networks/call-for-papers/recent-advances-in-ai-based-mobile-multimedia-computing

SWAYAM/NPTEL/MOOCs:

1. https://www.mooc-list.com/tags/multimedia
2. https://nptel.ac.in/courses/117/105/117105083/

SELF-LEARNING EXERCISES:

Multimedia applications including digital libraries, system software, toolkits, conferencing paradigms, structured interaction support, and examples from video/audio/graphics conferencing. Latest Web technologies, such as XML, X3D and Semantic Web.

Course Title	Augmented and Virtual Reality (PE-IV)				Course Type		Theory	
Course Code	B20EJS702	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW

This course covers basic concepts of augmented reality and virtual reality. The course also introduces the student to the working of multiple models of input and output interface in VR. The course also helps the student to understand development tools and frameworks in VR. Further, this course helps the student to work on the application of VR in digital entertainment.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain the principles and multidisciplinary features of Virtual Reality.

2.Illustrate the multimodal user interaction and perception in Virtual Reality.

3.Demonstrate the use of objects for managing large scale Virtual Reality environment in real time.

4.Discuss the various solutions using Virtual Reality system framework and development tools for industry and social relevant applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the components of Augmented and Virtual Reality	1 ,10	1
CO2	Apply multimodal user interaction and perception techniques involved in Virtual Reality.	1 to 3,5,10	3
CO3	Develop real world applications using Simulation and Interactive techniques.	1 to 3, 10	2,3
CO4	Choose the innovative Virtual Reality solutions for industrial and social relevant applications.	1,10	1

CO5	Evaluate current trends of AR and VR media delivery to propose options to potential clients, and discuss the benefits, challenges and misconceptions involved with working in AR and VR.	1,8,12	1,2
CO6	Evaluate various interaction schemes common to AR/VR experiences.	9,12	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5					√	
CO6					√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3									3			3		
CO2	3	3	3		3					3					3
CO3	3	3	3							3				3	3
CO4	3									3			3		
CO5	2							2					1	2	
CO6									2					2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Augmented Reality (AR): Definition and Scope, A Brief History of Augmented Reality, Examples, Related Fields, System Structure of Augmented Reality, Key Technology in AR.
Introduction to Virtual Reality (VR): Fundamental Concept and Components of VR, Primary Features and Present Development on VR.

UNIT – 2

Multiple Models of Input and Output Interface in VR: Input – Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus and 3D Scanner. Output – Visual, Auditory, Haptic Devices.

UNIT – 3

Environment Modelling in VR: Geometric Modelling, Behaviour Simulation, Physically Based Simulation. Interactive Techniques in VR: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT – 4

Development Tools and Frameworks in VR: Frameworks of Software Development Tools in VR, X3D Standard, Vega, MultiGen, Virtools, and Unity.
Application of VR in Digital Entertainment: VR Technology in Film and TV Production, VR Technology in Physical Exercises and Games, Demonstration of Digital Entertainment by VR.

TEXT BOOKS:

1.Dieter Schmaltzier and Tobias Hollerer,"Augmented Reality: Principles and Practice", Addison-Wesley, 2006.

2.Burdea, G. C. and P. Coffet. ,"Virtual Reality Technology", Second Edition. Wiley-IEEE Press, 2003/2006.

REFERENCE BOOKS:

1. Sherman, William R. and Alan B. Craig, "Understanding Virtual Reality – Interface, Application, and Design", Morgan Kaufmann, 2002.

2.Fei GAO, "Design and Development of Virtual Reality Application System", Tsinghua Press, March 2012.

3.Guangran LIU, "Virtual Reality Technology", Tsinghua Press, Jan. 2011.

4.International Journal of Virtual and Augmented Reality (IJVAR)

5.Springer, Virtual Reality.

JOURNALS/MAGAZINES

1. https://www.mdpi.com/journal/electronics/special_issues/VR_AR
2. https://www.sciencedaily.com/releases/2020/04/200420145025.htm
3. https://www.springer.com/journal/10055

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/106/106106182/
2. https://www.classcentral.com/course/augmented-reality-virtual-reality-mixed--10508
3. https://www.edx.org/learn/augmented-reality

Self-learning component:

Unity 3D, Manus VR

Course Title	Soft Computing Systems(PE-V)				Course Type		Theory	
Course Code	B20EJS703	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

This course covers basic concepts of soft computing concepts, neural network architectures, back propagation, fuzzy logic, fuzzy membership and rules.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Describe soft computing techniques and their applications
2. Explain the neural network architecture with the appropriate heuristics based on human experience.
3. Demonstrate the supervised and unsupervised learning with neural network concepts
4. Discuss fuzzy logic and neuro-fuzzy logic for real world applications

Course Out comes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply soft computing techniques and their applications.	1 to 5, 7,810,11,12,	1
CO2	Analyze various neural network architectures.	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the neural network with supervised and unsupervised learning.	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of fuzzy models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply softy computing Techniques for real time applications	1-12	3
CO6	Develop an algorithm using soft computing to an applications	1-12	3

BLOOM'S LEVEL

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√		√	
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	3	2	0	2	3	2	3	0	0
CO2	3	3	2	1	3	0	3	2	3	0	2	3	0	3	0
CO3	3	3	3	2	2	0	3	2	3	0	2	3	0	3	3
CO4	3	3	3	1	1	0	0	3	3	2	3	0	0	0	3
CO5	3	2	3	3	3	2	2	3	2	3	2	3	0	0	3
CO6	3	2	3	3	2	2	3	2	3	2	3	2	0	0	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT:

THEORY

UNIT – I **Introduction and Architecture of Neural Networks:** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various Course techniques; perception and convergence rule, Auto-associative and hetero-associative memory.
UNIT – II **Back Propagation Networks Architecture:** perception model, solution, single layer artificial neural network, multi layer perception model; back propagation Course methods, effect of Course rule co- efficient; back propagation algorithm, factors affecting back propagation training, applications.
UNIT – III **Introduction to Fuzzy Logic**: Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.
UNIT – IV **Fuzzy Membership and Rules:** Membership functions, interference in fuzzy logic ,fuzzy if-then rules, fuzzy implications and Fuzzy algorithms, Fuzzification and Defuzzification, Fuzzy Controller, Industrial applications.

TEXT BOOKS:

1. S. Rajsekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, 2003, Prentice Hall of India.
2. N. P. Padhy, Artificial Intelligence and Intelligent Systems, 2005, Oxford University Press.

REFERENCE BOOKS:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications,2010,WileyIndia.
2. Siman Haykin, Neural Networks,2009, Prentice Hall of India
3. Kumar Satish, Neural Networks,2004,TataMc.Graw.Hill

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2 https://www.journals.elsevier.com/applied-soft-computing

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms

Course Title	Python for Data Science (OE-III)				Course Type		Theory	
Course Code	B20CIO701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

This course covers fundamentals of Python programming, data preprocessing, sampling methods, Data Visualization techniques, it involves developing a method to analyzing data effectively to extract useful information and statistical method used in statistical decision using experimental data.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain the fundamentals of python programming

2.Discuss the data science and issues of Data science.

3.Describe the methods and programming tips of handling large data

4.Summarize the fundamentals of statistics and various Data Visualization techniques.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concepts of python programming to develop simple applications.	1,2,3,4,5	1,2
CO2	Make use of the concepts of data science for solving real world problem.	1,2,3,4,5	1,2
CO3	Identify the techniques which are suitable to handle large volumes of data for distributed data storage.	1,2,3,4,5	1,2
CO4	Analyze the results obtained using various visualization techniques on given data.	1,2,3,4,5	3

CO5	Learn new tools and technologies in the data science and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the data science to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3		√				
CO4			√	√		
CO5			√	√		
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	1								3	3	
CO2	2	2	1	2	2								3	3	
CO3	2	2	2	1	2								3	3	
CO4	2	2	1	2	2										3
CO5	2	2	2	2	2							2	2	2	
CO6	2	2	3	2	2				2	2				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT- 1

Introduction to concepts of OOPs: Objects and Classes, Data Abstraction, Encapsulation, Polymorphism and Inheritance. Difference between OOP and POP. Python IDEs

Your First Python Program: Diving in; Declaring Functions; Optional and Named Arguments, Writing Readable Code, Documentation Strings, The import Search Path, Everything Is an Object, What's an Object?, Indenting Code, Exceptions, Catching Import Errors, Unbound Variables

Native Data types: Booleans, Numbers, Coercing integers to Floats and Vice Versa, Numbers in a Boolean Context, Lists, Tuples, Sets, and Dictionaries

Comprehensions: Working with Files and Dictionaries, List Comprehensions, Dictionary Comprehensions, Set Comprehensions

UNIT- 2

Introduction: Introduction to Data Science: Definition: Big Data and Data Science Hype, Why Data Science, Getting Past the Hype, Current Landscape, Who is Data Scientist?, Data Science Process Overview, Defining goals, Retrieving data, Data preparation, Data exploration, Data modeling, Presentation.

UNIT -3

Handling large data on a single computer: The problems you face when handling large data, General techniques for handling large volumes of data, General programming tips for dealing with large data sets, Case study 1: Predicting malicious URLs, Case study 2: Building a recommender system inside a database. First Steps in Big data: Distributing data storage and processing with Frameworks, Case study: Assessing risk when loaning money.

UNIT- 4

Statistics: Introduction, Types of Statistics. Data Visualization and Interpretation: Histogram, Bar Charts, Scatter Plots, Good vs. Bad Visualization.

Sampling distributions; Point estimation - estimators, minimum variance unbiased estimation, maximum likelihood estimation, method of moments, consistency; Interval estimation.

TEXT BOOKS:

1. Mark Pilgrim, "Dive into Python 3", Apress special edition, second edition, 20l5.
2. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications Co., 1st edition, 2016.
3. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers,2006.
4. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann, 2011.
5. William Navidi ,"Statistics for Engineers and Scientists", McGraw Hill Education, India, 3rd Edition, 2013.

REFERENCE BOOKS:

1. 1.Mark Lutz, "Learning Python", Oreilly.2003.
2. John M. Zelle, "PYTHON Programming: An Introduction to Computer Science", Franklin, Beedle& Associates, 2009.
3. Michael Dawson, "Python Programming for the Absolute Beginners", 3rd Edition, CENAGE Learning, 2011.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person

Education, 2007.
5. K.P. Soman, Shyam Diwakar and V. Ajay “, Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2016.

JOURNALS/MAGAZINES

1. https://datascience.codata.org
2. https://www.springer.com/journal/41060
3. https://ieeexplore.ieee.org/document/8757088
4. https://www.ijcseonline.org/pub_paper/57-IJCSE-03229.pdf

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc21_cs33/preview
2. Python for Data Science, AI & Development -Coursera

Self-Learning Exercises:

Data Science using R, Creating own datasets, functions and packages in R and using packages in R

Course Title	Deep Learning (OE-III)				Course Type		Theory	
Course Code	B20CIO702	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic concepts of Deep Learning.
2. Describe supervised and unsupervised learning.
3. Demonstrate the use of a deep learning neural network in a real world application.
4. Illustrate the use of deep learning techniques in neural networks and natural language processing

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic concepts of mathematics to solve problems based on deep learning concepts.	1,2,3,4	1,2
CO2	Make use of suitable machine learning algorithms on real world problems (classification, clustering).	1,3,4,5,8	1,2
CO3	Utilize deep learning neural network model on real time applications.	1,3,4,5,8	1,3
CO4	Develop Recommender systems applications using CNN concepts of NLP.	1,2,4,5	1
CO5	Learn new tools and technologies in deep learning and apply for suitable application development.	1,2,3,4,5,12	1,2

CO6	Develop solutions in the deep learning to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9, 10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√			
CO3			√			
CO4						√
CO5			√	√		
CO6				√		√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2									3	3	
CO2	2		1	2	1			1					3	3	
CO3	1		1	2	2			1					3		3
CO4	1	1		2	1								3		
CO5	1	1	2	2	2							2	2	2	
CO6	2	2	2	2	2				2	2				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT-1

Machine Learning Basics: Linear Algebra-Scalors, Vectors, Matrices and Tensors, Eigen Decomposition, SVD, PCA Probability and Information Theory-Probability Distribution, Conditional Probability, Chain Rule of Conditional Probability, Bayes' Rule.

UNIT-2

Numerical Computation: Overflow, Underflow, Gradient Based Optimization, Constrained Optimization, Linear Least Squares, Machine Learning Basics- Learning Algorithms, Overfitting and Underfitting, Maximum Likelihood Estimation, Supervised and Unsupervised Learning Algorithms, Building Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT-3

Deep Networks: Modern Practices-Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architectural Design, Back-Propagation Algorithm.

UNIT-4

Convolutional Networks: Recurrent Neural Networks, Applications- Natural Language Processing, Recommender Systems.

TEXT BOOKS:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." First edition, An MIT Press book in preparation, 2015.

REFERENCE BOOKS:

1. Duda, R.O., Hart, P.E., and Stork, D.G. "Pattern Classification", Wiley-Interscience. 2nd Edition. 2001.

2. Theodoridis, S. and Koutroumbas, K. ,"Pattern Recognition", Edition 4. Academic Press, 2008.

3. Russell, S. and Norvig, N. ,"Artificial Intelligence: A Modern Approach", Prentice Hall Series in Artificial Intelligence. 2003.

JOURNALS/MAGAZINES

1. Springer Journal of Machine Learning, https://www.springer.com/journal/10994
2. http://ieeexplore.ieee.org/document/8297269/

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105215/

2. https://www.my-mooc.com/en/categorie/deep-learning

3. Deep Learning Specialization-Coursera

Self-Learning Exercises:

Linear factor Models, Structured probabilistics Models, Monte-Carlo Methods, Deep generative Models.

course Title	Summer Internship/Global Certification				Course Type		Practice	
Course Code	B20CI0701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	3	6	6	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**6**	**6**	-	**78**	-	**100**

COURSE OVERVIEW:

This course covers student's knowledge with industry.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Learn industry knowledge
2. Get certificate of emerging technologies

Course Out comes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,810,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
		√	√			
CO4		√				
CO5			√		√	
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

Note:1-Low,2-Medium,3-High

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2. https://www.journals.elsevier.com/
3. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms.

Course Title	Project Phase-1				Course Type		Practice	
Course Code	B20CI0702	Credits	4		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	4	8	8	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**4**	**8**	**8**	**-**	**104**	**-**	**100**

COURSE OVERVIEW:

This course covers student's innovation in current trends.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Learn current trends
2. Expose their knowledge with innovation methods to develop new technology

Course Outcomes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,810,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
		√	√			
CO4		√				
CO5			√		√	
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

Note:1-Low,2-Medium,3-High

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2. https://www.journals.elsevier.com/
3. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms

Detailed Syllabus
Semester 8

Course Title	Capstone - Project Phase-II				Course Type		Theory	
Course Code	B20CI0801	Credits	8		Class		VIII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	8	16	16	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**8**	**16**	**16**	**-**	**208**	**-**	**100**

COURSE OVERVIEW:

This course covers student's innovation in current trends.

COURSE OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Course Outcomes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5,7,810,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√		√	
CO6						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

Note:1-Low,2-Medium,3-High

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2. https://www.journals.elsevier.com/
3. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

Self Learning

Linear Algebra, probability and Information Theory, Genetic Algorithms

Course Title	IoT Programming (OE-IV)				Course Type		Theory	
Course Code	B20CI0801	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

The course covers the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. This course will get to know how to make design trade-offs between hardware and software. It also covers key components of networking to ensure that students understand how to connect their device to the Internet.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain basics of Arduino programs.
2. Illustrate sample programs to interface sensors to aurdino board storead, process and analyze data.
3. Demonstrate WebApp storead and stored at a from sensors, and to monitor and control IoT devices.
4. Discuss IoT programming to develop larger smart products useful for the society.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop programs to interface sensors to Aurdino board stored, process and analyze data.	1,2,3,4,5,6	3
CO2	Analyse the performance of Communication Protocols used in real time IoT Projects.	1,2,3,4,5,6	1
CO3	Make use of different IoT Patterns to develop the real world applications.	1,2,3,4,5,6	1
CO4	Identify the IoT security requirements to solve the given real world problem.	1,2,3,4,5,6	1
CO5	Learn new IoT tools and technologies and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the IoT problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		√
CO2				√		
CO3			√			√
CO4		√	√			
CO5			√	√		
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2									3
CO2	2	3	3	2	2	3							3		
CO3	3	3	2	2	3	3							3		
CO4	3	3	3	3	3	2							3		
CO5	3	3	3	2	3							2	2	2	
CO6	3	2	2	2	2				3	2				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT- 1

Building Blocks: Arduino Basics, Hardware Requirements, Software Requirements: Toolbar, StatusWindow, Serial Monitor Window; Arduino Programming Language Reference Internet Connectivity:ArduinoUno Wired Connectivity (Ethernet), Hardware Required, Software Required Circuit, Code(Arduino), Final Product; ArduinoUno Wireless Connectivity(WiFi), Hardware Required, Software Required, Circuit, Code (Arduino), FinalProduct

Communication Protocols: HTTP: Code (Arduino), Final Product; MQTT: Intrusion Detection System, Remote Lighting Control, Code (Arduino), Final Product

UNIT -2

Complex Flows: Node-RED:HardwareRequired, Software Required, Circuit, Node-REDFlow, Code (Arduino), External Libraries, Internet Connectivity (Wireless),Read Sensor Data, Data Publish, Standard Functions and the FinalProduct.

IoT Patterns: Real-time Clients: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Code (Android): Project Setup, Screen Layout, Screen Logic, MQTT Client and the Final Product.

IoT Patterns: Remote Control: Hardware Required, Software Required, Circuit, Code (Android): Project Setup, Screen Layout, Screen Logic; MQTTClient,Code(Arduino):External Libraries, Internet Connectivity(Wireless) ,Data Subscribe, Control Lights, Standard Functions and the Final Product.

UNIT- 3

IoT Patterns: On-Demand Clients: Hardware Required, Software Required, Circuit, Database Table(MySQL), Code(PHP): Database Connection, Receive and Store Sensor Data, Get the Parking Spot Count; Code(Arduino): External Libraries, Internet Connectivity(Wireless), Read Sensor Data;Code(iOS): Project Setup, Screen Layout, Screen Logic and the Final Product.

IoT Patterns: Web Apps: Hardware Required, Software Required, Circuit, Database Table (MySQL),Code(PHP): Database Connection, Receive and Store Sensor Data, Dashboard; Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the FinalProduct.

IoT Patterns: Location Aware: Hardware Required, Software Required, Circuit, Database Table(MySQL),Code(PHP):Database Connection, Receive and Store Sensor Data, Map; Code (Arduino):External Libraries, Get GPSCoordinates, Data Publish, Standard Functions and the Final Product.

UNIT-4

IoT Patterns: Machine to Human: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Effektif Workflow: Process Creation, Process Configurations; Node-RED Flow and the Final Product.

IoT Patterns: Machine to Machine: Light Sensor Device, Code (Arduino): Lighting Control Device, Code (Arduino) and the Final Product

IoT Platforms: Hardware Required, Software Required, Circuit, Xively Setup, Zapier Setup, Xively Trigger, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the Final Product.

Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT -

Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities - Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption - Attack & Fault trees

TEXT BOOKS:

1. Adeel Javed,"Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications", Apress,2015.
2. BrianRussell, DrewVanDuren,"PracticalInternetofThingsSecurity(KindleEdition)",2016

REFERENCE BOOKS:

1. Agus Kurniawan, "Smart Internet of Things Projects ", Packt Publishing,2016.

JOURNALS/MAGAZINES

1. https://www.researchgate.net/publication/266854342_On_IoT_programming
2. https://jisajournal.springeropen.com/about/new-content-item
3. https://ieeexplore.ieee.org/document/8628483/
4. https://ieeexplore.ieee.org/document/8845363

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. An Introduction to Programming the Internet of Things (IOT) Specialization -Coursera

Self-Learning Exercises:

Explore any one of the boards like Raspberry Pi, Intel Galileo, Beagle Bone Black, Dragon Board, UDOO DUAL/QUAD, ARM Boards, DIY Development boards for IoT prototyping (C.H.I.P, MediatekLinkit One, Particle Photon, Tessel, Adafruit Flora, LightBlue Bean, Udoo Neo, Intel Edison)

Course Title	Reinforcement Learning				Course Type		Theory	
Course Code	B20CIO802	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW

This course covers fundamental principles and techniques in deep and reinforcement learning. Topics include convolutional neural networks, recurrent and recursive neural networks, backpropagation algorithms, regularization and optimization techniques for training such networks, dynamic programming, Monte Carlo, and temporal difference, and function approximation reinforcement learning algorithms, and applications of deep and reinforcement learning.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe back propagation algorithms to train deep neural networks and apply regularization techniques.
2. Explain optimization techniques to train deep neural networks and convolutional neural networks.
3. Discuss recurrent neural networks to analyze basic deep learning algorithms for speech recognition, face recognition, object recognition and NLP.
4. Demonstrate reinforcement learning algorithms for real time applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the concepts of Deep Feedforward Networks to train deep neural networks.	1,2,3,4,5,6	1
CO2	Utilize optimization techniques in deep neural networks and convolutional neural networks for real world application.	1,2,3,4,5,12	1
CO3	Develop recurrent neural networks algorithm for analysis of NLP applications.	1,2,3,4,5,6,9,12	1
CO4	Solve real world complex problems using reinforcement learning algorithms.	1,2, 4,5 ,6	1,2
CO5	Learn new reinforcement algorithms and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the reinforcement learning algorithms for complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3				√		√
CO4			√			
CO5			√	√		
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2							3		
CO2	1	2	1	1	1							1	3		
CO3	3	2	1	2	2	1			1			1	3		
CO4	2	1		2	2	1							3	3	
CO5	2	1	2	2	2							2	2	2	
CO6	2	2	2	2	2				2	2				2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT-1

Deep Networks: Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms**. Regularization for Deep Learning**: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier.

UNIT-2

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms. **Convolutional Networks:** The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function,

Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

UNIT-3

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence, Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, **Applications:** Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing.

UNIT-4

The Reinforcement Learning Problem: Reinforcement Learning, Elements of Reinforcement Learning, Limitations and Scope. Multi-arm Bandits :An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search, **Finite Markov Decision Processes** : The Agent–Environment Interface , Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Function, Optimality and Approximation, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville Deep Learning, MIT Press, 2016.

2. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction” second edition, the MIT PRESS,2015.

REFERENCE BOOKS:

1. Abhishek Nandy, Manisha Biswas, Reinforcement Learning: With Open AI, TensorFlow and Keras Using Python, Apress,2017.

2. Eugene charniak, Introduction to Deep Learning, The MIT Press, 2018.

JOURNALS/MAGAZINES

1. https://ieeexplore.ieee.org/document/6025669
2. https://ieeexplore.ieee.org/document/7301554
3. https://www.jair.org/index.php/jair/article/view/10166
4. http://www.ijstr.org/final-print/mar2020/A-Study-Of-Reinforcement-Learning-Applications-Its-Algorithms.pdf

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs27/
2. Reinforcement Learning, Practical Reinforcement Learning-Coursera

Self-Learning Exercises:

Implement and apply Monte Carlo reinforcement learning algorithms, implement and apply temporal-difference reinforcement learning algorithms.

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF MECHANICAL ENGINEERING

M.Tech

in

Machine Design

HAND BOOK

2019-21

Rukmini Knowledge Park
Kattigenahalli, Yelahanka, Bengaluíu – 560064
www.reva.edu.in

REVA UNIVERSITY
Bengaluru, India

School of Mechanical Engineering

M.Tech. (Machine Design)

HAND BOOK

2019-2021

Approved by Board of Studies

BOS/ME/MDD/2014-15/01/30-09-2014
BOS/ME/MDD/2015-16/02/30-04-2015
BOS/ME/MDD/2016-17/03/23-05-2016
BOS/ME/MDD/2017-18/04/13-05-2017
BOS/ME/MMD/ 2018-19/05/06-06-2018
BOS/ME/MMD/2019-20/05/13-04-2019

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
PhoneNo:+91- 80 4696 6966, +91- 90211 90211

Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is Power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju

The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr. S. Y. Kulkarni
Vice-Chancellor, REVA University

Director's Message

It is my pleasure to welcome you to the PG Studies under the School of Mechanical Engineering. M. Tech. in Machine Design–a postgraduate program is designed to create motivated, innovative, creative and thinking graduates to fill the roles of Machine Designers who can conceptualize, design, analyze and develop machines to meet the modern day requirements.

Students completing M. Tech. in Machine Design program will have ample opportunities in premier research organizations like DRDO, ISRO, HAL, NAL and other CSIR institutions. Many OEM's, MNCs and private companies like SAFRAN, ALTAIR, GE, BOEING, AIRBUS, TATA MOTORS etc., are looking for the dynamic post-graduate candidates specialized in design aspects with CAE based software packages.

This handbook presents the M.Tech. Curriculum for Machine Design Program. The program is of 2 years duration and spilt into 4 semesters. The student admitting to this program has to earn 96 credits spread across four semesters to obtain the M.Tech degree.

The curriculum caters to and has relevance to local, regional, national, global developmental needs. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

The important features of M.Tech. in Machine Design are as follows:

1. Choice Based Course Selection (CBCS system).
2. Curriculum framed and taught by senior most faculty members.
3. All theory subjects integrated with practical component.
4. Long term internship.
5. Opportunity to pursue MOOC course as per interest.
6. Research based academic projects.

I am sure that students choosing M.Tech. (Machine Design) will benefit a lot from the industry based curriculum, teaching and learning environment, vast infrastructure, teacher's involvement and guidance.

I wish all PG students a pleasant and exploring stay in REVA University and grand success in their career.

Dr. K. S. Narayanaswamy
Director-School of Mechanical Engineering

CONTENTS

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 15,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 12000+ students studying in various branches of knowledge at graduate and post graduate level and 431 Scholars pursuing research leading to PhD in 21 disciplines. It has 900+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core

subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others.

These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is **'Life Time Achievement Award'** to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the **"Founders' Day Celebration"** of REVA University on 6th January of every year in presence of dignitaries, faculty members and students gathering. The first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence"** in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVOTSAVA conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important

event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around. Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honored with many more such honors and recognitions.

ABOUT SCHOOL OF MECHANICAL ENGINEERING

Mechanical Engineering is one of the oldest and classical branches of engineering which drives the development and economy of the country .The school of Mechanical Engineering in REVA University has a rich blend of experienced, energetic and dedicated faculty with highest qualification in the specialization of thermal, design, manufacturing and management streams. The school has well-furnished class rooms and well equipped laboratories with modern software tools to meet academic and industry requirements. The research Centre with modern equipment and testing facility is also available to cater research activities in the field of materials and bio-fuels. Extracurricular and co-curricular activities are conducting to develop additional skills, knowledge and confidence through University Industry Interaction Cell and various student clubs and student chapters with the support of industries. Industry persons are invited to give technical talks on latest technologies and students are deputed for internship in industries and universities in India and Abroad. The school is having MOU with reputed industries and universities in India and abroad for internship, research and twinning program or higher studies which will give more exposure of our students to outside world. Many students have done internship in reputed institutions like IISc, ISRO, DRDO, HAL, Rail Wheel factory, Volvo and many more. Every semester school is organizing industry visits to reputed organizations to learn various aspects of industry. Student clubs and chapters are highly active in the school which are MARS, ISHRAE Student Chapter, Foundry Man Society, Fluid Power Society, SAE club and Aryan Racing Team through which cultural events, training programs, invited talks, industry visits and placement activities are conducting. School is encouraging the students to participate in national and international level competitions like Solar car design, Electric vehicle design, Formula car design, ATV design, Go-Cart design and quiz competition through this student can learn additional skills like design, team management, time management and financial aspects. Additional training programs are conducting in the field of automobile, robotics, and manufacturing to impart skills with industry relevant. The School is organizing workshops, seminars, conferences and competitions in national and international level for the students, faculty and research scholars to enhance their skills and research trends. The school offers B.Tech in Mechanical Engineering, M.Tech. in Machine design and PhD program. The curriculum of both UG and PG is designed to meet the needs of the society and industry for present and future.

It also meets the requirements of higher studies in India and abroad and also for the requirement of competitive exams. In overall, school will support and make our students more disciplined, good human being and more responsible persons of the society.

Vision

"Aspires to be recognized globally for outstanding value based education and research leading to well-qualified mechanical engineers, who are innovative, entrepreneurial, successful in their career and committed to the development of the country."

Mission

1. To impart quality education to the students and enhance their skills to make them globally competitive mechanical engineers.

2. To promote multidisciplinary study and cutting edge research and expand the frontiers of mechanical engineers profession.

3. To create state-of-art facilities with advanced technology for providing students and faculty with opportunities for innovation, application and dissemination of knowledge.

4. To prepare for critical uncertainties ahead for mechanical engineering and to face the challenges through clean, green and healthy solution.

5. To collaborate with industries, institutions and such other agencies nationally and internationally to undertake exchange programs, research, consultancy and to facilitate students and faculty with greater opportunities for individual and societal growth.

ADVISORY BOARD

Sl No.	Particulars of Members
1	**Dr. N. V. Ravikumar** Associate Professor, Department of Metallurgy & Materials Engineering, IIT Madras
2	**Mr. K. N. Narsimha Murthy** Chairman, Fluid Air Systems, Bangalore. Hon. Treasurer, Karnataka Small Scale Industries Association (KSSIA)
3	**Prof. M. V. Krishna Murthy** Former Professor Dept. Mechanical Engineering IIT Chennai, Madras, Former Director, VIT, Vellore
4	**Mr. Praveen Kumar Jinde** Scientist, NAL, Bangalore
5	**Dr. K Ramachandra** Former Director, GTRE, Bangalore CEO, NP-MICAV's National Design Research Forum The Institute of Engineers, Bangalore.
6	**Prof. E. Abhilash** Dept. Mechanical Engineering, King Khalid University Abha, Kingdom of Saudi Arabia.

"When a young man leaves the institution after a course of training, he should be clean in speech and habit with a correct sense of patriotism, loyalty to the country, aptitude for initiative, love for self-help, appreciation of the value of time, respect for law and order, and a knowledge of the value of the right thinking and right living, sufficiently well-equipped to fall into a position in some business or other and be able to support himself."

- **Sir. M. Visvesvaraya**

M.Tech. in Machine Design

Program Overview

Mechanical Engineering discipline applies the principles of physics and materials science for design, analysis, prototyping, manufacturing, and maintenance of mechanical systems. Mechanical Engineers specialize in subject areas like Machine Design, Manufacturing and Energy Conversion (Thermal power) depending on individual's interest through postgraduate education and research routes.

The School of Mechanical Engineering at REVA UNIVERSITY offers M. Tech., in Machine Design–a postgraduate program to create motivated, innovative, creative and thinking graduates to fill the roles of Machine Designers who can conceptualize, design, analyze and develop machines to meet the modern day requirements.

The first intellectual and creative activity in development of a new equipment is product or industrial design and the subsequent activity is the Machine Design. Machine design is the process of engineering design. A machine is made up of mechanisms that work together to satisfy the requirements of what the machine needs to accomplish. Machine design takes into account kinematics and kinetics, which deal with motion and the forces on an object in motion. Machine design is applied through a specific process including determining what the machine needs to do, benchmarking and defining goals and requirements, brainstorming, evaluating and selecting from the different options, creating an in-depth design, creating and testing a prototype, and finally manufacturing the machine.

In summary, machine design is about recognizing the need, arriving at specifications, synthesis, analysis, prototyping and evaluation and producing drawings for manufacturing.

Mechanical engineers work in the domains of automobile engineering, aerospace engineering, machine tools, Internal combustion engines, cement industry, steel industries, power sector, hydraulics, manufacturing plants, drilling and mining industry, petroleum, general engineering, biotechnology and many more. Nowadays they are also increasingly needed in the environmental and bio-medical fields. There are exciting times ahead for mechanical engineers as transport technologies like hyper loop, electric vehicles, flying cars, drone technologies, intelligent system like robots and additive manufacturing including 3D printing are gaining importance. These mechanical engineering domains need machine

designers to create machines that not only meet the functional, aesthetic, ergonomic requirements but must also be economical to operate and maintain, robust, sustainable and intelligent.

In this context, The School of Mechanical Engineering at REVA UNIVERSITY would like to add to the growing human resources needs of industry as machine designers through its M. Tech. program in Machine Design.

Program Educational Objectives (PEOs)

The aim of the program is to produce postgraduates with advanced knowledge and understanding of contemporary machine design; higher order critical, analytical, problem solving and transferable skills; ability to think rigorously and independently to meet higher level expectations of industry, academics, research establishments or take up entrepreneurial route.

The **Program Educational Objectives** are to prepare the students to:

1. Be machine designers to design mechanical equipment, machines and mechanical systems as per the desired customer specifications.
2. Pursue doctoral research degree to work in colleges, universities as professors or as scientists in research establishments.
3. Act as administrators in public, private and government organizations or business administrator or entrepreneur with further training.

Program Outcomes (POs)

After undergoing this program, a student will be able to:

PO1: Demonstrate in-depth knowledge of Machine Design, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge on design concepts, and integration of the same for enhancement of knowledge.

PO2: Analyze complex design problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3: Think laterally and originally, conceptualize and solve mechanical design problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4: Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate **research methodologies, techniques and tools, design**, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in the domains of mechanical design engineering.

PO5: Create, select, learn and **apply** appropriate techniques, resources, and **modern engineering and IT tools**, including prediction and modeling, to complex mechanical design engineering activities with an understanding of the limitations.

PO6: Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to **collaborative-multidisciplinary scientific research**, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7: Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a **member and leader in a team**, manage projects efficiently in mechanical design and multidisciplinary environments after consideration of economical and financial factors.

PO8: Communicate with the engineering community, and with society at large, regarding complex mechanical design engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: Recognize the need for, and have the preparation and ability to engage in **life-long learning** independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10: Acquire professional and intellectual integrity, professional **code of conduct**, **ethics of research** and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11: Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and **learn from mistakes** without depending on external feedback **(SELF learning).**

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of the programme, the post graduates shall be able to

PSO 1: Apply Machine Design engineering knowledge, skills and competency in Design and analysis of systems related to Automotive, Mechanical, Aerospace Engineering and allied areas to obtain realistic outcomes.

PSO 2: Identify, formulate, analyze and solve problems in mechanical design engineering and allied domains.

PSO 3: Conduct investigations in the areas of numerical analysis, vibration analysis, material failure, mechanism synthesis to provide optimal and sustainable solutions.

M.Tech. (Machine Design) Program

Scheme of Instruction

(Effective from the Academic Year 2019-21)

SEMESTER-I

SI No	Course Code	Title of the course	Types of course (HC/ SC)	Credit Pattern			Credit Value	Total Hours
				L	T	P		
FIRST SEMESTER								
1	M18MD1010	Numerical Methods	HC	3	0	1	4	5
2	M18MD1020	Geometric Modeling and Prototype	HC	3	0	1	4	5
3	M18MD1030	Synthesis and Analysis of Mechanisms	HC	3	0	1	4	5
4	M18MD1040	Advanced Mechanics of Solids	HC	3	0	1	4	5
5	M18MD1050	Finite Element Procedure – I	FC	3	0	1	4	5
6	M18MD1061	Design and Analysis of Engineering components	SC	3	0	1	4	5
	M18MD1062	Design of Experiments						
	M18MD1063	Advanced Materials						
7	M18MD1071	Theory of Plates and Shells	SC	3	1	0	4	5
	M18MD1072	Design for Manufacturing and Assembly						
	M18MD1073	Vehicle Dynamics						
		Total		**21**	**1**	**6**	**28**	**35**
Total Credits for the First Semester							**28**	**35**

- **Note:** Courses contain relevant lab component in each unit in order to give Practical Exposure to students.

SEMESTER-II

SI No	Course Code	Title of the course	Types of course (HC/ SC)	Credit Pattern			Credit Value	Total Hours
				L	T	P		
1	M18MD2010	Experimental Stress Analysis	HC	3	0	1	4	5
2	M18MD2020	Finite Element procedure – II	HC	3	0	1	4	5
3	M18MD2030	Advanced Theory of Vibration	HC	3	0	1	4	5
4	M18MD2040	Tribology and Bearing Design	HC	3	1	0	4	5
5	M18MD2050	Mechanics of Composite Materials	HC	3	0	1	4	5
6	M18MD2061	Machine Tool Design	SC	4	0	0	4	4
	M18MD2062	Mechatronics Product Design						
	M18MD2063	Rotor Dynamics						
7	M18MD2071	Advanced Machine Design	SC	4	0	0	4	4
	M18MD2072	Robotics and its Application						
	M18MD2073	Optimization in Engineering Design						
		Total		23	1	4	28	33
		Total Credits for the Second Semester					**28**	**33**

SEMESTER-III

SI No	Course Code	Title of the course	Types of course (HC/SC)	Credit Pattern			Credit Value	Total Hours
				L	T	P		
1	M18MD3010	Fatigue and Fracture Mechanics	HC	3	1	0	4	5
2	M18MD3020	Open Elective (Modern Automotive System)	OE	3	1	0	4	5
3.	M18MD3030	Internship with Report	RULO	0	0	6	6	12
4	M18MD3040	Project Phase-I	HC	0	0	4	4	8
5	M18MD3050	Yoga/ Sports/ Theatre/ Music / Dance	RULO	0	0	2	2	2
			Total	**6**	**2**	**12**	**20**	**32**
						Total Credits for the Third Semester	**20**	32

SEMESTER-IV

1	M18MD4010	Project/Dissertation/Seminar	HC	0	0	16	16	-
2	M18MD4020	MOOC/ SWAYAM/ On line program	RULO	4	0	0	4	-
			Total	**4**	**0**	**16**	**20**	**-**
						Total Credits for the Fourth Semester	**20**	
						Total Credits of all Four Semesters	**96**	

Note: 1) Soft Core (SC): Student shall opt for one SC course of his/her choice from the groups framed

2) Open Elective (OE): These are the courses that are offered for the students of other Schools. The students of the School of Mechanical Engineering have to **choose ONE Open Elective offered by other schools**.

Modern Automotive System (M18MD3020) is the open elective course which is being offered by School of Mechanical Engineering to the students of other schools.

Guide lines for Internship/Project Work:

1. **Internship:** should be carried out in a reputed /Tier-1/R & D organization, preferably, internship should be with stipend. The internship should be approved by the REVA University authorities before completion of 3rd semester and the students should obtain the permission for the same by producing the necessary details of company, selection process, and the offer letter issued by the company. At the end of the Internship, detailed report must be submitted.
2. **Project work:** Phase-1 comprises of literature survey, review paper writing, and problem formulation, identification of tools and techniques, and methodology for the project. Phase – 2, in

4th semester should have a visible outcome in the form of publication in a reputed International Conference/Journal or copyright or patent filing.

Semester-wise Summary of Credit Distribution

Semesters	No. of Credits
First Semester	28
Second Semester	28
Third Semester	20
Fourth Semester	20
Total Credits	**96**

Distribution of Credits Based on Type of Courses

Semester	HC	FC	SC	OE	RULO	TOTAL
I	16	04	08	-	-	28
II	20	--	08	-	-	28
III	08	--	--	04	08	20
IV	16	--	--	-	04	20
Total	**60**	**04**	**16**	**04**	**12**	**96**

HC=Hard Core; SC=Soft Core; OE=Open Elective;
RULO=REVA Unique Learning Offerings

Distribution of Credits Based on L: T: P

Semester	L	T	P
I	21	1	6
II	23	1	4
III	6	2	12
IV	4	0	16
Total	**54**	**4**	**38**

M.Tech. (Machine Design) Program

DETAILED SYLLABUS

FIRST SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hr/wk
M18MD1010	**Numerical Methods**	**HC**	**3**	**0**	**1**	**4**	**5**
Prerequisite: Engg. Mathematics-I, II, III & IV		Internal Assessment			Semester End Exam		
		50 Marks			50 Marks		
Course Objectives	1. To enhance the knowledge of numerical methods, optimization, partial differential equations, hyperbola and curve fitting. 2. These concepts occur frequently in their subjects like finite element method and other design application oriented subjects.						
Course Outcomes	After the completion of the course the student will be able to: 1. Model simple mathematical models of physical application. 2. Determine and optimize engineering problems in Science and engineering. 3. Differentiate and integrate a function for a given set of tabulated data, for engineering application. 4. Analyze Curve fitting methods for given applications.						
Unit:1	**Introduction to Numerical Methods &Numerical Integration**				12 Hours		
Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations, Matrix notation, Determinants and inversion, Iterative methods, Relaxation methods, system of non-linear equations, computer programs. **Numerical integration**: Newton-Cotes integration formulas, Simpson's rules, Gaussian quadrature. Adaptive integration. **Lab Component: Solving linear and non-linear equations using MATLAB commands**							
Unit:2	**Optimization**				11 Hours		
Optimization: One dimensional unconstrained optimization, multidimensional unconstrained Optimization –direct methods and gradient search methods, constrained optimization Boundary value problems and characteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.							
Unit:3	**Numerical solutions of partial differential equations**				11 Hours		
Numerical solutions of partial differential equations: Laplace's equations, Representations as a difference equation, Iterative methods for Laplace's equations, Poisson equation, Examples, Derivative boundary conditions , Irregular and non-rectangular grids , Matrix patterns, Sparseness , ADI method , Parabolic partial differential equations: Explicit method, Crank-Nickelson method, Derivative boundary condition, Stability and convergence criteria. **Lab Component: Solving partial and ordinary differential equations using MATLAB**							

commands(PDE23 & ODE45)		
Unit:4	**Hyperbolic partial differential equations & Curve fitting**	11 Hours
Hyperbolic partial differential equations: Solving wave equation by finite differences stability of numerical method, Method of characteristics-wave equation in two space dimensions-computer programs. **Curve fitting and approximation of functions**: Least square approximation fitting of nonlinear curves by least squares, regression analysis, multiple linear regression, nonlinear regression - computer programs **Lab Component: Exercises on curve fitting using MATLAB commands**		
Text Books:	1. Steven C. Chapra, Raymond P.Canale,(2000), **"***Numerical Methods for Engineers***",** Tata Mc-Graw Hill. 2. Curtis F.Gerald, Partick.O.Wheatly, (1989), "*Applied numerical analysis***"** Addison-wesley. 3. Douglas J.Faires, Riched Burden (1998) "*Numerical methods***"** Brooks/cole publishing company.	
References:	1. Ward Cheney & David Kincaid (1999)"*Numerical mathematics and computing*" Fourth Edition Brooks / Cole publishing Company. 2. Riley K.F.M.P.Hobson & Bence S.J, (1999) "*Mathematical methods for physics and engineering*" Cambridge university press.	

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO 9 (i)	PO 10 (j)	PO 11 (k)
CO_1	√						√				
CO_2	√					√					
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hrs/wk
M18MD1020	**Geometric Modelling and Prototyping**	HC	4	0	1	5	5
Prerequisite: Engg. Drawing, Computer Aided Machine Drawing, CAD/CAM/CIM		Internal Assessment			Semester End Exam		
		50 Marks			50 Marks		

Course Objectives	1. To make to students to understand the differences & advantages of using latest development in Digital drafting over conventional methods. 2. To make students to understand the concept and application of geometric modeling. 3. To enable the students to understand GD&T and its application. 4. To teach reverse engineering and Rapid prototyping techniques.
Course Outcomes	**By the end of this course, the students will be able to** 1. Understand and learn advantages of digital drafting over conventional methods. 2. Apply the knowledge of geometrical modeling to real problems. 3. Draft a model with knowledge of GD& T and RP techniques 4. Understand and learn advantage of using digital tools for design.

Unit:1	**Introduction to CAD, CAM, CIM and CAPP**	12 Hours

Concept of CAD /CAM, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labelling, Zoom, pan, redraw and regenerate, wire frame modelling, surface modelling and solid modelling in relation to latest CAD packages. CIM as a concept and a technology, CASA/Sme model of CIM, CIM II, benefits of CIM.

Unit:2	**Engineering Drawing Fundamentals & GD& T**	11 Hours

Overview engineering drawing orthographic projections, pictorial representations, sectioning of solids, dimensioning standards, fundamental dimensioning rules. fundamental of metrology, Concepts of GD& T and its applications.

Unit:3	**Geometric modelling**	11 Hours

Geometric modelling - Types and Mathematical Representations of Surfaces: Surface models, surface entities, surface representation, parametric representation of analytic surfaces and synthetic surfaces, simple problems.

Unit:4	**Introduction to Rapid prototype, Reverse Engineering & Rapid Prototype Techniques.**	11 Hours

Introduction: Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling. Classification of RP systems, Stereo lithography systems – Principle – process parameters – process details – machine details, Applications. Concepts of reverse Engineering, its application with case studies Concept of 3D printer.		
Text Books	1. Ibrahim Zeid., R.Sivasubramanian,.(2005), "CAD/CAM : THEORY & PRACTICE". Second Edition, special Indian edition., McGraw Hill Publication. 2. Rafiq Noorani.,(2005)"Rapid Prototyping: principles and applications", kindle edition. 3. Robert W.Messler Jr.,(2013) "Mechanisms, structures, systems & materials". McGraw Hill Publication. 4.Chee Kai Chua,. Kah Fai Leong,. & Chu Sing,.Lim., "Rapid Prototyping: Principles and Applications". 3rd Edition. world Scientific publishing Co.Pte.Ltd.	
References	1. P. Radhakrishnan., S. Subramanyan., V. Raju (2008) "CAD/CAM/CIM", Third Edition, New Age International(P) limited, Publisher. 2. D. D. Bedworth., M. R. Henderson., P. M. Wolfe.,(1991) " Computer Integrated Design and Manufacturing" McGraw-Hill. 3. M.P.Groover., and E. W. Zimmer.,(2003) "CAD/CAM Computer Aided Design and Manufacturing", 1First Edition, Pearson Education. 4. Chua.,(2010) "Rapid Prototyping Principles and Applications". 3rd edition, YesDee Publishing Private Limited.	

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO 10 (j)	PO 11 (k)
CO_1	√						√				
CO_2	√					√					
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1030	**Synthesis and Analysis of Mechanisms**	HC	3	0	1	4	5
Prerequisite: Theory of Machines I and II		Internal Assessment			Semester End Exam		
		50 Marks			50 Marks		

Course Objectives	1. It aims at finding out degrees of freedom for any given mechanism 2. Help to provide the designer concept to control the position of any mechanism at a particular instant of time. 3. It helps in solving the mechanism both analytically and graphically 4. Teach the Freudenstein's equation and to gives an idea about the manipulator and its dynamics
Course Outcomes	After successful completion of the course the student shall be able to 1. Explain the concept of inversion, degrees of freedom, velocity and acceleration for any given mechanism. 2. Generate the motion for a particular expression and find out the different points traced by a mechanism. 3. Solve the mechanism problems both analytically and graphically by using different methods like number analysis, dimensional analysis etc. 4. Understand and classify dynamics behavior of manipulators.

Unit1:	**Introduction and Mechanics of different Mechanisms**	**11 Hours**

Introduction - Links - Pairs - Chain - Mechanism - Machine structure - Degrees of freedom - Four bar chains - Terminology and definition - Planer, Spherical and Spatial Mechanisms - Grashoff's law - Kutzback criterion - Grubler's criterion for plane mechanism. Inversion of mechanisms - Four bar, single slider crank and double slider crank mechanisms - Simple problems - Instantaneous center - Kennedy's theorem - Velocity and Acceleration of Four bar and single slider crank mechanisms by relative velocity Method

Lab Component: Analyzing the mechanism using Adams

Unit2:	**Velocity , Acceleration and Introduction to motion generation**	**12Hours**

Position, Velocity and Acceleration analysis, Static force analysis, Inertia forces in machines, Synthesis of Mechanisms: Type, number and dimensional synthesis, Coupler curve Introduction, tasks of Kinematics Synthesis, Graphical synthesis: Motion generation-two and three prescribed motions, Path generation – three prescribed positions, prescribed timings, four positions without prescribed timings, Function Generator: Three prescribed points, Introduction to Analytical synthesis three prescribed positions for motion, path and function generation, circle, point and center-point circles,

Lab Component: Analyzing the mechanism using Adams

Unit 3	**Analytical and Graphical Method of motion generation**	**12 Hours**

Freudenstein's equations for three point function generation, order synthesis, Coupler cognate mechanisms. - Graphical Methods: Precision positions Over lay Method. Analytical Methods: Blotch's Synthesis - Freudestien's Method - Coupler curve Synthesis - Cognate linkages - The

Roberts - Chebyshev theorem ***Lab component: Analyzing the mechanism using Adams***		
Unit 4:	**Manipulators and its dynamics**	**10 Hours**
Manipulators : Classification, actuation and transmission systems, coordinate systems, coordinate transformations-DH notations, inverse and forward kinematics, Manipulator dynamics from Lagrangian and Newtonian point of view ***Lab component: Simulation of various manipulators using MATLAB***		
Text Books	1. George N Sandor and Arthur G Erdman, (1988), "Mechanism Design", VOL – 1, PHI. 2. George N Sandor and Arthur G Erdman, (1988), "Mechanism Design", VOL – 2, PHI. 3. Joseph E Shigley (2005), Theory of Machines &Mechanism Design, Third Edition, Oxford Publications.	
References	1. Klafter R.D., Cmielewski T.A. and Negin (1994), Robot Engineering An Integrated Approach, New Delhi, M Prentice Hall. 2. Deb S.R (1994), Robotics Technology and Flexible Automation, Second Edition, Tata McGraw Hill Publishing Co.,Ltd.	

Mapping of Po's and Co's

Program outcomes Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO 10 (j)	PO_{11} (j)
CO_1			√								
CO_2			√								
CO_3			√				√				
CO_4			√								

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1040	**Advanced Mechanics of Solids**	HC	3	0	1	4	5
Prerequisite: Engg. Mathematics, Material Science & Metallurgy, Mechanics of Materials.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand equilibrium equation for elastic body and to obtain stress-strain components for the elastic component. 2. Provide systematic basic knowledge for Two Dimensional Problems and Cubical Dilation, True Stress – Strain. 3. Provide systematic basic knowledge Uniqueness Theorem and Plastic Deformation of Metals. 4. To enable the students to understand Yield Criteria and Stress Strain Relations.
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of equilibrium equation and analyze the Stress and Strain. 2. Formulate Cubical Dilation, True Stress and Strain, two dimensional problems. 3. Formulate the Uniqueness Theorem and Plastic Deformation of Metals. 4. Determine the Stress Strain Relations and Yield Criteria.

Unit:1	**Analysis of Stress-Strain Relation**	12 Hours

Analysis of Stress: Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr's Diagram, Maximum Shear Stress, Boundary Conditions.

Analysis of Strain: Compatibility Equations, Principal Strains, Generalized Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress- Plane Strain Problems.

Lab Component: Determine the stresses and strain of Tensile test specimen of Al,Copper and Brass material.

Unit:2	**Cubical Dilation, Two Dimensional Problems**	12 Hours

Cubical Dilation, True Stress and Strain: Strain tensor, principal strain, plane strain, spherical and deviator strain, octahedral strain and representative strain, problems

Two Dimensional Problems: Cartesian co-ordinates, Airy's stress functions, Investigation of Airy's Stress function for simple beam problems, Bending of a narrow cantilever beam of rectangular cross section under edge load, pin ended beam under uniform pressure.

Lab Component: Determine the **Bending of a narrow cantilever beam of rectangular cross section under edge load**

Unit:3	**Uniqueness Theorem & Plastic Deformation of Metals.**	12 Hours

Uniqueness Theorem: Principle of super position, reciprocal theorem, saint venant principle.

Plastic Deformation of Metals: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, recrystallization and grain growth, flow figures or luder's cubes.

Lab Component: Determine the **Crystalline structure in metals**

Unit:4	**Stress Strain Relations and Yield Criteria**	09 Hours

Stress Strain Relations: Introduction, types of materials, empirical equations, theories of plastic flow, experimental verification of St.Venant's theory of plastic flow, the concept of plastic potential, the maximum work hypothesis, mechanical work for deforming a plastic substance **Yield Criteria:** Introduction, yield or plasticity conditions, Von Mises and Tresca criteria, Geometrical representation, yield surface, yield locus (two dimensional stress space), experimental evidence for yield criteria, energy required to change the shape with basic principle problems **Lab Component: Determine the concept of plastic potential**	
Text Books	1. L. S. Srinath (2008), Mechanics of solids, ,Tata McGraw Hill, 3rd Edition 2. S. P. Timoshenko and J. N Gordier(1972) Theory of Elasticity, , Mc.Graw Hill International, 3rd edition.. 3. Chakraborty (2000), Theory of Plasticity, 3rd Edition Elsevier. 4. 'Engineering Plasticity',(2000) W. Johnson and P. B. Mellor D Van N.O Strand Co. Ltd .
References	1. Dr. Sadhu Singh (1988), Theory of Elasticity, 5th Edition, Khanna Publications. 2. Seetharamu & Govindaraju (2005), Applied Elasticity, Interline Publishing, New-Delhi. 3. C.T. WANG , (1953) , Applied Elasticity, McGraw Hill Book Co.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3	√						√				
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1050	**Finite Element Procedures-1**	FC	3	0	1	4	5
Prerequisite: Mechanics of Materials/Engg Mathematics			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and heat transfer problems. 2. To provide systematic and comprehensive knowledge of basics of Finite element method as an analysis tool. 3. To teach the students the characteristics of various elements and selection of suitable elements for the problems being solved. 4. To make the students derive finite element equations for simple and complex elements. 5. To make the student solve for field variable for thermal composite wall problems.
Course Outcomes	**By the end of the course, the students will be able to** 1. Describe the different types of analysis methods, types of FE elements, various approaches in Finite Element Method, 2. Analyze the Interpolation polynomials by Euler-Lagrange equations and Solution to 1-D Bars using FE package 3. Determine the stiffness matrix and unknown DOFs of Trusses and derive shape functions for Higher Order Elements 4. Derive Hermite Shape function and apply it to solve beam problems.

Unit:1	**Introduction**	11 Hours

Background of Various Stress analysis methods, comparison of FEM with classical methods. Advantages and limitations of FEM, Steps involved in FEM, Applications of FEM and FEM Packages.

Discretization: Element shapes and behavior – Choice of element types – size and number of elements – Element shape and distortion – Location of nodes – Node and Element numbering.

Different approaches in Finite Element Method –Principle of minimum PE

Lab Component: Meshing of given machine member using a FE Software

Unit:2	**Interpolation Models and Solution of 1-D Bars**	11Hours

Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements.2D PASCAL's triangle. CST elements-Shape functions in NCS, Strain displacement matrix and Jacobian for triangular element.(no derivation)

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and

stresses by using penalty approach and elimination approach. **Lab Component: Solving various bar problems using a FE Software**		
Unit:3	**Trusses and Higher Order Elements**	11 Hours
TrussesStiffness matrix of Truss element. Numerical problems **Higher Order Elements:** Lagrange's interpolation, Higher order one dimensional elements- Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral elements. Iso parametric, Sub parametric and Super parametric elements. Numerical integration: 1 and 2 gauss point for 1D case. **Lab Component: Solving the given truss using a FE Software**		
Unit:4	**One Dimensional Problems – Beams and Frames**	12 Hours
Finite Element Modeling of a basic beam element in local coordinate system using energy approach; Formulation of element matrices; Assembly of the Global Stiffness Matrix, Mass matrix and Load vector; Treatment of boundary Conditions; Euler Bernoulli (thin) beam element and Timoshenko (thick) beam element; Beam element arbitrarily oriented in plane (2D) as Plane frames and in space as space frame analysis (3D). **Lab Component: Solving the given beam using a FE Software**		
Text Books	1.Bhavikatti S.S,(2006), **'***Finite Element Analysis'*, 4th edition, New Delhi, New Age International publishers. 2. Chandrapatla T.R. and A.D Belegunde A.D, (2008), **'***Finite Elements in Engineering',* 3rd edition, New Delhi, PHI.	
References	1. Daryl. L. Logon, (2001), *Finite Element Methods*, 3rd edition, New york, Thomson Learning. 2. Cook R.D, D.S Maltus D.S, Plesha M.E.,Witt R.J.(2009), *Concepts and applications of Finite Element Analysis*, 4th Edition, London, Wiley.	

Mapping of Po's and Co's

Program outcomes Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO 11 (k)
CO_1					√						
CO_2					√		√				
CO_3					√						
CO_4					√						√

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1061	**Design and Analysis of Engineering Components**	SC	3	1	0	4	5
Prerequisite: Machine Design Advanced Mechanics of Solids/Engg Mathematics.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand the mathematical and physical principles of solid mechanics and thier problems. 2. To provide systematic and comprehensive knowledge of basics of Design methods and tool. 3. To teach the students various challenges of Design of elements and selection of suitable elements for the problems being solved. 4. To make the students to derive inference from the design of simple and complex elements.
Course Outcomes	**By the end of the course, the students will be able to** 1. Describe the different types of Practical design methods and various approaches of design. 2. Identify the evidences of various failures through microscopic methods. 3. Analyze failures caused due to hot corrosion and stress corrosion. 4. Demonstrate the theoretical understanding of failure mechanisms.

Unit:1	**Introduction**	11 Hours
Perform design calculations, generate 2D Drawings based on design calculations and create 3D Models, Perform Finite Element Analysis on 3D models and evaluate the design for automotive components like Connecting rod of an IC Engine, Crankshaft of an IC Engine etc., Choose operating specifications for any commercial Automobile and perform the analysis for realistic operating conditions		
Unit:2	**Failure analysis through microscopy**	11Hours
Introduction: Material failure modes and their identification; Tools for failure analysis: Optical microscopy, Transmission electron microscopy, Scanning electron microscopy. Systematic approach to failure analysis.		
Unit:3	**Mechanical aspects**	11 Hours
Tensile test, Static loading, Combined stress, Principal stresses, Theories of failure, Triaxial stresses and constraint, Plane stress, Plane strain, Stress concentration factors and notch sensitivity. Shock and impact loading.		
Unit:4	**Fatigue Failure Analysis**	12 Hours
Analysis of Fatigue: Loading under high cycle fatigue conditions, Test methods, Failures related to corrosion, hot corrosion and stress corrosion cracking, Damages due to hydrogen, Creep of metallic materials, service failures during high temperature service; Failures related to wear.		

Text Books	1. C. R. Brooks and A. Choudhury (2002), Failure Analysis of Engineering Materials, McGraw-Hill 2. Richard G. Budynas, J. Keith Nisbett,, Shigley,(2010) 'Mechanical Engineering Design' , 9th Edition, The McGraw-Hill Companies. 3. Robert C. Juvinall Kurt M. Marshek, (1995), 'Fundamentals of Machine Component Design', John Wiley & Sons, Inc.
References	1. Joseph E. Shigley, Charles R. Mischke , "Standard handbook of machine design", 2nd Edition, The McGraw-Hill Companies. 2. Robert C. Juvinall, Kurt M. Marshek "Machine Design Component Design" 5Th Edition, International Student Version, John Wiley & Sons, Inc.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO 11 (k)
CO_1				√							
CO_2		√					√				
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1062	**Design of Experiments**	SC	3	1	0	4	5
Prerequisite: Engineering Mathematics, Design of machine elements			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To make students to understand the Concepts of random variable, probability, density function cumulative distribution function. Sample and population 2. To enable students to identify Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, 3. To understand & identify the Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graph sand Interaction assignment, Dummy level Technique 4. To educate the students **,** Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy
Course Outcomes	After successful completion of the course the student shall be able to 1. Identify the various controllable & uncontrollable factors on the design of experiments. 2. Experiment under various situation to solve Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization. 3. Apply the Experiment Design Using Taguchi's Orthogonal Arrays. 4. Describe the Signal To Noise Ratio, Parameter And Tolerance Design.

Unit1:	**Introduction**	**11 Hours**

Introduction: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

Basic Statistical Concepts: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical **Distributions:** Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

Unit2:	**Experimental Design, Analysis And Interpretation Methods**	**12Hours**

Experimental Design: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

Analysis And Interpretation Methods: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental

data. Illustration through Numerical examples.		
Unit 3	**Quality of Experimental Design**	**12 Hours**
Quality By Experimental Design: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function**. Robust Design**: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples. **Experiment Design Using Taguchi's Orthogonal Arrays:**Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphsand Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs.Illustration through Numerical examples.		
Unit 4:	**Signal To Noise Ratio, Parameter And Tolerance Design**	**10 Hours**
Signal To Noise Ratio: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples. **Parameter And Tolerance Design:** Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.		
Text Books	1. Douglas C. Montgomery, (2007), 'Design and Analysis of Experiments' 5th Edition Wiley India Pvt. Ltd. 2. Madhav S. Phadke,(1989), 'Quality Engineering using Robust Design' Prentice Hall.	
References	1. Thomas B. Barker, (1985), 'Quality by Experimental Design', MarcelDekker Inc ASQC Quality Press. 2. C.F. Jeff Wu Michael Hamada, (2002), 'Experiments planning, analysis, and parameter Design optimization', John Wiley Editions. 3. W.L. Condra, (1985), 'Reliability Improvement by Experiments' MarcelDekker, Inc ASQC Quality Press.. 4. Phillip J. Ross,(1996), 'Taguchi Techniques for Quality Engineering', 2nd Edition, . McGraw Hill International Editions.	

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO 4 (d)	PO_5 (e)	PO_6 (f)	PO 7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√						√				
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1063	**Advanced Materials**	SC	3	1	0	4	5
Prerequisite: Material Science, Manufacturing Technology.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	The objectives of this subject are to provide the students with: 1. An understanding of the principles, capabilities, limitations and applications of commonly used advanced materials. 2. To emphasize the significance of materials selection in the Composite materials. 3. To comprehend the importance of shape memory and super alloys. 4. To get familiarize with the new concepts of Nano Science and Technology.
Course Outcomes	Upon completion of the subject, students will be able to: 1. Select appropriate advanced material for the specific applications. 2. Characterize the different composite materials and Smart Materials. 3. Select the shape memory and super alloys for engineering practice. 4. Choose appropriate Nano materials for different types of applications.

Unit:1	**Metals and Alloys**	11 Hours

Metals and Alloys: Classification and characteristics: Metals, Ceramics, Polymers and composites. Ferrous Alloys: properties, structure.

Non Ferrous alloys: Alloys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.

Unit:2	**Composites**	11Hours

Composites: Definition, classification and characteristics of composite materials , Metal Matrix Composites, Polymer matrix composites and Ceramic matrix Composites and its Applications

Smart Materials: Review of Composite Materials, Definition and classification of Smart Materials, Smart Materials (Physical Properties) Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, and Self-Healing Polymers.

Unit:3	**Super alloys & shape memory alloys:**	11 Hours

Super alloys & shape memory alloys: Ni-based, Fe-based, Co-based super alloys, and properties and its applications, Cu-based and NiTi shape memory alloys properties and its applications. High temperature alloys: Classification of Titanium alloys, properties and applications, heat treatment and machining of Ti alloys.

Unit:4	**Nanoscience and Nanotechnology**	12 Hours

Introduction to Nanoscience and Nanotechnology**:** Basic concepts of Nanoscience and Nanotechnology, Carbon nanotubes – Material processing by chemical vapor deposition and physical vapor deposition – Potential uses of nanomaterials in electronics, robotics, computers, sensors, sports equipment, mobile electronic devices, vehicles and transportation – Medical applications of nanomaterials.

Text Books	1. William D. Callister Jr (2008), *Materials Science & Engineering-. An introduction*, 4th edition, London, John Wiley & Sons. 2. R. A. Flinn& P. K. Trojan (2007), *Engg. Materials & their applications*-, 4th edition, Jaico Publishing House. 3. M. V. Gandhi and B. So Thompson (1992) *Smart Materials and Structures, London*, Chapman & Hall. 4. Thiruvadigal, J.DPonnusamy, S, Sudha.D. and Krishnamohan, .(2013), *Materials Sciences*- Chennai ,M Vibrant Publication. 5. Rajendran.V (2011), *Materials Science*, New Delhi, Tata McGraw-Hill.
References	1. James.F. Shackleford (2010), *Introduction to Material Science and Engineering*, 7thedition. New York, MacMillan publisher. 2. Chawla K.K, (1998), *Composite Materials - Science and Engineering*, 2nd edition, Newyork, Springer – Verlag. 3. Mick Wilson, KamaliKannangara (2005), *Nanotechnology – Basic Science and Emerging Technologies*, 1st edition, Overseas Press India Private Limited.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1		√									
CO_2		√					√				
CO_3		√									
CO_4		√									

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1071	**Theory of Plates and Shells**	SC	3	1	0	4	5
Prerequisite: Machine Design, FEM, MOM			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand Different Boundary Conditions for plates. 2. Provide systematic basic knowledge for Circular plates subjected to Axi-symmetrical loads 3. To enable the students to understand Finite difference method, Finite element methodology for plates, 4. Formulate to understand the basic principles of the Membrane and bending theory for singly curved and doubly curved shells
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of Simple bending of Plates and analyze the Plates subjected to lateral loads 2. Formulate Circular plates subjected to Axi-symmetrical loads 3. Apply the Rayleigh-Ritz method for bending of plates and shells. 4. Derive the equations of Shells and Classification of shells.

Unit:1	**Simple bending of Plates**	12 Hours

Simple bending of Plates-Assumptions in thin plate theory, Different relationships, Different Boundary Conditions for plates, Plates subjected to lateral loads, Navier's method for simply supported plates, Levy's method for general plates ,Example problems with different types of loading.

Unit:2	**Circular plates subjected to Axi-symmetrical loads**	12 Hours

Circular plates subjected to Axi-symmetrical loads, concentrated load, uniformly distributed load and varying load, Annular circular plate with end moments.

Unit:3	**Rayleigh-Ritz method**	11 Hours

Rayleigh-Ritz method: Application to different problems, Finite difference method, Finite element methodology for plates, Orthotropic Plates Bending of anisotropic plates with emphasis on orthotropic plates, Material Orthotropic, Structural Orthotropic, Plates on elastic foundation.

Unit:4	**Shells**	10 Hours

Shells- Classification of shells - Membrane and bending theory for singly curved and doubly curved shells - Various approximations - Analysis of folded plates.

Text Books	1. S.P.Timoshenko and S.Woinowsky ,(1959), Theory of plates and shells Krieger, McGraw-Hill. 2. A.C.Ugural,(1999), 'Stresses in plates and shells', McGraw-Hill.
References	1. Analysis of plates, T.K.Varadan and K.Bhaskar, Narosa Publishing House, 1999. 2. Stresses in Shells, Flugge. Blaisdell Publishing Co, 1966 3. Design and construction of concrete shell roofs by G.S.Ramaswamy, CBS Publishers& Distributors, 1986. 3. Rudolph Szilard, Theory and Analysis of Plates, Prentice Hall, New Jercy 1986.

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Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1				√							
CO_2				√			√				
CO_3				√							
CO_4				√							

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1072	**Design for Manufacturing and Assembly**	SC	3	1	0	4	5

Prerequisite Design**:** SOM, Manufacturing Technology, Machine.	Internal Assessment	Semester End Exam
	50 Marks	50 Marks

Course Objectives	1. To enable the students to understand General design principles for manufacturability, strength and mechanical factors, mechanisms selection. 2. Provide systematic basic knowledge for Working principle, Material, Manufacture, Design Possible solutions, Materials choice, 3. To enable the students to understand Design features to facilitate machining - drills - milling cutters, keyways, Doweling procedures 4. Formulate the Identification of uneconomical design, Design for economy, Design for clamp ability, Design for accessibility, modifying the design.
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of evaluation method, Process capability, Feature tolerances, Geometric tolerances, Assembly limits, Datum features, Tolerance stacks. 2. Formulate Factors Influencing Form Design: Working principle, Material, Manufacture, Design Possible solutions. 3. Determine the Component Design in Machining &Casting Considerations. 4. Design for Manufacture and Case Studies, Identification of uneconomical design, Design for economy.

Unit:1	**Introduction**	12 Hours

Introduction: General design principles for manufacturability, strength and mechanical factors, mechanisms selection, evaluation method, Process capability, Feature tolerances, Geometric tolerances ,Assembly limits, Datum features ,Tolerance stacks.

Unit:2	**Factors Influencing Form Design**	11Hours

Factors Influencing Form Design: Working principle, Material, Manufacture, Design Possible solutions, Materials choice, Influence of materials on from design from design of welded members, forgings and castings.

Unit:3	**Component Design in Machining &Casting Considerations**	11 Hours

Component Design Machining Consideration: Design features to facilitate machining - drills - milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area - simplification by separation, simplification by amalgamation, Design for machinability.
Component Design Casting Considerations: Redesign of castings based on parting line considerations, Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

Unit:4	**Design for Manufacture and Case Studies**	11 Hours

Design for Manufacture and Case Studies: Identification of uneconomical design, Design for economy, Design for clamp ability, Design for accessibility, Modifying the design, Design for assembly, Group technology, Computer Applications for DFMA.

Text Books:	1. Design for Manufacture, Harry Peck, Pittman Publication, 1983.
References:	1. Engineering Design - A systematic approach, Robert Matousek, Blackie & sons Ltd. 2. Hand Book of Product Design for Manufacturing, James G. Bralla, McGraw Hill Co.

	3. Knowledge based design for manufacture, Swift K.G, Kegan Page Ltd., 1987.

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Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√			√							
CO_2	√			√							
CO_3	√			√							
CO_4	√			√							

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD1073	**Vehicle Dynamics**	SC	3	1	0	4	5
Prerequisite: Engg. Mathematics, Mechanical vibration, Kinematics, Mechanics of Materials.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	
Course Objectives	1. To know about the application of basic mechanics principles for dynamic analysis of vehicles. 2. To study the behavior of vehicle.						
Course Outcomes	After completion of the course the student will be able to 1. Describe how passenger comfort is achieved along with vehicle stability. 2. Predict the various forces and loads and performance under acceleration, ride and braking. 3. Derivate the dynamic equations governing a road vehicle. 4. Solve the fundamental problems in vehicle dynamics.						
Unit 1	**Concept of Vibration**					12 Hours	
Definitions, Modelling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, T wo DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.							
Unit 2	**Vehicle Dynamics and Fundamentals of Load Transfer**					11 Hours	
Introduction to Vehicle Dynamics, Vehicle Performance-Acceleration & Braking; Ride and Handling, Estimation of Road Loads, Tractive Resistance and Tractive Force, Newton's Law and developing equations for forces acting on vehicle axles, longitudinal and lateral load transfer, estimating load on individual wheel, gradeability, Static Stability Factor.							
Unit 3	**Vehicle Ride**					11 Hours	
Sources of Vibration. Ride Rate and Vehicle natural frequency, damping coefficient and variable damping ratio, passive, Semi-active and active dampers suspension systems, Quarter car, Half car and full car models response analysis, Vehicle pitch and roll analysis, Influence of suspension stiffness, suspension damping, and tire stiffness, Air suspension system and their properties.							
Unit 4	**Lateral dynamics**					11 Hours	
Steady state handling characteristics, Steady state response to steering input, Stability of vehicle parked on level road, parked on inclined road, accelerating car on level and inclined road, Parked Car on a Banked Road, Optimal Drive and Brake Force Distribution, Vehicles with More Than Two Axles, Vehicles on a Crest and Dip-Vehicles on a Crest and Vehicles on a Dip, Effect of suspension on cornering							
Text Books	1. Rao, S.S. and Yap, F.F., (2011), Mechanical vibrations (Vol. 4). Upper Saddle River: Prentice Hall. 2. Wong, J.Y., (2008), Theory of ground vehicles. John Wiley & Sons. 3. Rajamani, R., (2011), Vehicle dynamics and control. Springer Science & Business Media. 4. Gillespie, T.D., (1992), Fundamentals of vehicle dynamics. Warrendale,						

	PA: Society of Automotive Engineers, 519.
References	1. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004 2. Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008 3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004 4. Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005 5. John C. Dixon," Tires, Suspension, and Handling", 2nd edition, Society of Automotive Engineers Inc, 1996 6. Jan Zuijdijk, 'Vehicle dynamics and damping", Author House, 2009

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Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO 11 (j)
CO_1	√			√							
CO_2	√			√							
CO_3	√			√							
CO_4	√			√							

SECOND SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2010	**Experimental Stress Analysis**	HC	3	0	1	4	5
Prerequisite: Engg. Mathematics, SOM, TOE, MMM.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To understand the relation between Problems using plane stress and plane strain conditions 2. To establish the fundamental concepts of static recording and data logging and newly experimental Brittle coatings techniques. 3. To be able to use the experimental techniques on the Coating stresses and strains, mechanism of formation of Moire fringes in practical problems. 4. To be able to understand Plane and circularly polarized light, locking in model deformation
Course Outcomes	After Completion of the course student shall be able to: 1. Describe the Sensitivity & the construction of strain gauges. 2. Describe the Recording Instruments & Brittle coatings. 3. Explain the Bi- refringent Coatings & Moire Methods. 4. Describe the Photo Elasticity & Three-dimensional Photo Elasticity.

Unit:1	**Strain Measurement Methods**	12 Hours

Introduction: Theory of Elasticity, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, Three-dimensional stress strain relations.

Strain Measurement Methods: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits.

Lab Component: To determine the young's, modulus the given material with the help of strain rossets& load cell.

Unit:2	**Recording Instruments & Brittle coatings**	12 Hours

Recording Instruments: Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, and crack detection, ceramic based brittle coatings, and resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, and analysis of brittle coating data.

Unit:3	**Bi- refringent Coatings & Moire Methods**	11 Hours

Bi-refringent Coatings: Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

Unit:4	**Photo Elasticity&Three-dimensional Photo Elasticity**	10 Hours
Photo Elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics **Three-dimensional Photo Elasticity :** Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear difference method in three dimensions, applications of the Frozen-stress method, the scattered light method. ***Lab Component: To determine the fringe constants for photo elastic material by using polariscope.***		
Text Books	1. Dally and Riley, "Experimental Stress Analysis", McGraw Hill. 2. Sadhu Singh, "Experimental Stress Analysis". Khanna publisher. 3. Srinath L.S Experimental stress Analysis, Tata McGraw Hill.	
References	1. M.M.Frocht "Photoelasticity Vol I and Vol II, John Wiley &\ sons. 2. Perry and Lissner,"Strain Gauge Primer", 3. Kuske, Albrecht & Robertson "Photo Elastic Stress Analysis", John Wiley & Sons. 4. Dave and Adams,"Motion Measurement and Stress Analysis",v	

Mapping of Po's and Co's

Program outcomes Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO 11 (k)
CO_1	√										
CO_2	√										
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2020	**Finite Element Procedures-II**	HC	3	0	1	4	5
Prerequisite: Finite Element Procedures-1			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to dynamic and heat transfer problems. 2. To provide systematic and comprehensive knowledge of basics of Finite element method as applied to axis symmetric problems 3. To teach the students the characteristics of various elements and selection of suitable elements for the problems being solved. 4. To make the student solve for field variable for thermal composite wall problems.
Course Outcomes	After Completion of the course student shall be able to: 1. Compute Eigen Vector and Eigen Values of 1D and 2 D problems 2. Knowledgeable about the FEM as a numerical method for the solution of solid mechanics, structural mechanics and thermal problems 3. Developing skills required to use a commercial FEA software 4. Apply FEM method to solve 1D heat transfer problems and composite walls.

Unit:1	**Formulation of dynamics analysis**	11 Hours

Finite Element Formulation for point/lumped mass and distributed masses system: Finite Element Formulation of one dimensional dynamic analysis: bar and beam element. **Finite Element Formulation of Two dimensional dynamic analysis:** triangular membrane and axisymmetric element, quadrilatateral membrane. Evaluation of eigen values and eigen vectors applicable to bars, beams.

Lab Component: Finding out of Eigen Vector and Eigen Values of given member using a FE Software

Unit:2	**Vector Variable problems - Plane stress, Plane Strain and Axi-symmetric Analysis**	11Hours

Equilibrium equation formulation – Energy principle and formulating the element matrices - Plane stress, plane strain and axi-symmetric elements; Orthotropic materials; Iso-parametric Elements; Natural coordinate system; Four-node Quadrilateral for Axisymmetric Problems; Hexahedral and tetrahedral solid elements; Linear, Quadratic and cubic elements in 1D, 2D and 3D, C_0 and C_1 continuity elements

Lab Component: Solving Axis symmetric problems using a FE Software

Unit:3	**Finite Element Formulations for Structural Mechanics Problems:**	11 Hours
Basics of plates and shell theories: Classical thin plate Theory, Shear deformation Theory and Thick Plate theory. Finite Element Formulations for triangular and quadrilateral Plate elements. Finite element formulation of flat, curved, cylindrical and conical Shell elements **Lab Component: Solving the given plate using a FE Software**		
Unit:4	Heat transfer problems	12 Hours
Steady state heat transfer, 1D heat conduction governing equations, Galerkin's approach for heat conduction and solution for composite walls. Solving the field problems such as heat transfer in automotive cooling fin, engine cover. **Lab Component: Solving the given heat transfer problem using a FE Software**		
Text Books	1. Seshu. P, (2013),Finite Element Analysis Prentice Hall of India. 2. S.S. Bhavikatti (2006) Finite Element Analysis New Age International publishers, 3. T.R.Chandrapatla, A.D Belegunde, Finite Elements in Engineering 3rd Ed PHI.	
References	1. Daryl. L. Logon, Finite Element Methods Thomson Learning 3rd edition, 2001. 2. J.N.Reddy, Finite Element Method,McGraw -Hill International Edition. 3. R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Concepts and applications of Finite Element Analysis Wiley 4th Ed, 2009.	

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO 11 (k)
CO_1					√						
CO_2					√						
CO_3					√						
CO_4					√						

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2030	**Advanced Theory of Vibration**	HC	3	0	1	4	5
Prerequisite: Engg Mathematics, Mechanical Vibrations			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand response to periodic and non-periodic excitations. 2. To teach students about transient Vibration by Laplace transformation formulation. 3. To enable students to solve free vibration of spring - coupled systems under 2DoFs 4. To apply modal analysis to forced vibrations using matrix inversion for MDOF systems. 5. To understand the importance of condition monitoring techniques. 6. To apply SPM and AE techniques in analyzing machine failures.
Course Outcomes	After completion of the course, the student will be able to 1. Apply Duhamel's Integral in solving Impulse response function. 2. Analyze transient vibrations using Laplace transformation formulation and analyze MDOF systems for Eigen values and Eigen vectors. 3. Apply SPM and AE methods to identify machine failures. 4. Analyze the fan bearings and gas compressors for the faults.

Unit:1	**Review of Fundamentals of vibration and 2 DOF systems**	12 Hours

Fundamentals of vibration: Review of Single degree system - Response to periodic and non-periodic excitations - Duhamel's Integral – Impulse Response function - Single degree freedom forced vibration with elastically coupled viscous dampers.

Two degree of freedom systems: Free vibration of spring - coupled systems-Simple problems

Lab Component: Carrying out harmonic and non-harmonic excitation of mechanical systems using FE package.

Unit:2	**Multi-degree of freedom system and Continuous systems**	11 Hours

Multi-degree of freedom system: Normal mode of vibration - Flexibility Matrix and Stiffness matrix - Eigen values and Eigen vectors - orthogonal properties - Modal matrix, Modal Analysis - Forced Vibration by matrix inversion.

Vibration of continuous systems: Vibration of strings-wave equations - vibration of rods - Euler Equation for Beams - Effect of Rotary inertia and shear deformation.

Lab Component: Carrying out modal and harmonic analysis of continuous systems

Unit:3	**Condition monitoring methods and Vibration analysis**	11 Hours

Condition monitoring methods and Vibration analysis: Various Condition Monitoring Methods, Economics of Condition Monitoring, Setting up a CM Activity.

Machinery signatures, Vibration severity criteria, Vibration frequency domain and time domain analysis, Shock Pulse Methods for testing Antifriction bearings, Acoustic emission technique (AET)-

Instrumentation, Transducers, Preamplifier and filter, Main amplifier and Signal processing/ Display unit. **Lab Component:** Obtaining and analyzing machinery vibration signatures using accelerometer and FFT analyzer.		
Unit:4	**Condition Monitoring Case Studies & Applications:**	11 Hours
Failure of fan bearings- History of failures, Analysis of the failures, Solution. High frequency vibration of gas compressor-History of trouble, Analysis of trouble, Solution. Monitoring of cracks in rotors- Turbo compressor misalignment. Detection of faulty electrical components. Turbine shell distortion. Symptoms and Detections. **Lab Component:** Collecting and analyzing machinery vibration signatures of defective parts.		
Text Books	1. S. S. Rao, 'Mechanical Vibrations', Pearson Education Inc, 4th edition, 2003. 2. V. P. Singh, 'Mechanical Vibrations', Dhanpat Rai & Company, 3rd edition, 2006. 3. Update CEP ISTE New Delhi, 'Condition Monitoring and condition based maintenance'. 4. R. A. Caollacatt, Chapman, 'Mechanical Fault Diagnosis and Condition Monitoring', Chapman and hall 1977.	
References	1. G. K.Grover, 'Mechanical Vibrations', Nem Chand and Bros, 6th edition, 1996. 2. W. T. Thomson, M. D. Dahleh and C. Padmanabhan, 'Theory of Vibration with Applications', Pearson Education Inc, 5th edition, 2008. 3. S. Graham Kelly, 'Mechanical Vibrations', Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.	

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										√
CO_2	√						√				
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2040	**Tribology and Bearing Design**	HC	3	1	0	4	5
Prerequisite: Engg. Mathematics, MSM, MOM.			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. Recognize the properties of lubrication, Regimes of Lubrication 2. Identify the Hydrodynamic Lubrication 3. Identify types of Slide Bearing & Journal Bearings 4. Knowledge about Hydrostatic Bearings, EHL, Porous & Gas Bearings
Course Outcomes	Upon Completion of the course student shall be able to: 1. Identify the fundamentals of Effect of Pressure and Temperature on Viscosity, types of Viscometers. Friction. 2. Detect the pressure distribution of hydrodynamic bearings analytically and experimentally. 3. Investigate the life-cycle of a journal nearing and Idealized Slide Bearing 4. Design the Hydrostatic Bearings, EHL, Porous & Gas Bearings

Unit:1	**Introduction to Tribology**	12 Hours

Introduction, properties of lubrication, Regimes of Lubrication, Classification of Contacts, Lubrication Theories. Newton's Law of Viscous Forces, Effect of Pressure and Temperature on Viscosity, types of Viscometers. Friction, Wear, Wear Characteristics.

Lab Component: Viscosity measuring using Red-wood, Saybolt viscometers, Pin on disk wear testing.

Unit:2	**Hydrodynamic Lubrication**	12 Hours

Hydrodynamic Lubrication: Flow through Stationary Parallel Plates. Hagen's Poiseuille's Theory. Numerical Problems. Concept of Lightly Loaded Bearings, Petroff's Equation, Numerical Problems.

Hydrodynamic Bearings: Pressure Development Mechanism. Converging and Diverging Films and Pressure induced Flow. Reynolds's 2-D Equation with assumptions.

Lab Component: Determination of pressure distribution using journal bearing test rig.

Unit:3	**Slide Bearing & Journal Bearings**	12 Hours

Idealized Slide Bearing: Introduction, Idealized Slide Bearing with Fixed Shoe and Pivoted Shoes. Expression for Load Carrying Capacity. Location of Centre of Pressure, Numerical Problems.

Journal Bearings: Introduction to Idealized Full Journal Bearings. Load Carrying Capacity of Idealized Full Journal Bearings, Sommerfeld Number and its Significance. Comparison between Lightly Loaded and Heavily Loaded Bearings, Numerical Problems.

Unit:4	**Hydrostatic Bearings,Porous & Gas Bearings**	09 Hours

Hydrostatic Bearings: Types of Hydrostatic Lubrication Systems Expression for Discharge, Load Carrying Capacity, Flow Rate, Condition For Minimum Power Loss. Torque Calculations. Numerical Problems.

Porous & Gas Bearings: Introduction, Working Principle, advantages and disadvantages.

Magnetic Bearings: Introduction, Active Magnetic Bearings, Working Principle, advantages and disadvantages.

Text Books	1. L. S. Srinath, 'Advanced Mechanics of solids', Tata Mc. Graw Hill,2003 2. S. P. Timoshenko and J. N Gordier , 'Theory of Elasticity', Mc.Graw Hill

	International, 3rd edition, 1972
References	1. Dr. Sadhu Singh, 'Theory of Elasticity', Khanna Publications, 1988 2. Martin H Sadd , 'Elasticity, Theory, Applications &Numericals', Elsevier. 2005 3. Seetharamu & Govindaraju , 'Applied Elasticity', Interline Publishing 4. C.T. WANG Sc. D., 'Applied Elasticity', McGraw Hill Book Co.1953

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√						√				
CO_3	√										
CO_4				√							

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2050	**Mechanics of Composite Materials**	HC	3	0	1	4	5
Prerequisite: SOM, Composites materials, Advance materials			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To teach the students to introduction of composite materials 2. To perform micromechanical and macro mechanical analysis of a lamina. 3. To introduce to various biaxial strength theories and macro mechanical analysis of a laminate. 4. To provide a detailed knowledge of Strength Theories& analyze the macro mechanical analysis of laminate. 5. To provide thorough knowledge on coefficient of thermal expansion and other thermal properties of laminates.
Course Outcomes	After completion of the course the student will be able to 1. Describe the materials used for composites. 2. Analyze the micro/macro mechanical behavior of lamina 3. Describe the various biaxial strength theories and analyze macro mechanical analysis of a laminate. 4. Determine the coefficient of thermal expansion and other thermal properties of laminates

Unit:1	**Introduction to Composite Materials**	11 Hours

Composite Materials Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites,

Unit:2	**Micro & macro Mechanical Analysis of a Lamina**	12Hours

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture.

Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic Constants, Two – dimensional relationship of compliance and stiffness matrix Numerical problems

Unit:3	**Strength Theories& analysis**	11 Hours

Biaxial Strength Theories: Maximum stress theory, Maximum strain theory, Numerical problems.

Macro Mechanical Analysis of Laminate: Introduction, code, Kirchhoff hypothesis, CL T, A, B, and D matrices, Special cases of laminates, Numerical problems**.**

Unit:4	**Thermal Analysis**	11 Hours

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

Text Books	1. Composite Science and Engineering, K. K. Chawla Springer Verlag

	1998. 2. Mechanics of composite materials, Autar K. Kaw CRC Press New York
References	1. Fiber Reinforced Composites, P. K. Mallick, Marcel Dekker,Inc 2. Mechanics of Composite Materials, Robert M. Jones, McGraw Hill Kogakusha Ltd.1998 3. Composite materials hand book, Meing Schwaitz," McGraw Hill book company.1984 4. Principles of composite Material mechanics, Ronald F. Gibron. McGraw Hill international, 1994. 5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay , UniversitiesPress 2009

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO 10 (j)	PO_{11} (k)
CO_1	√										
CO_2	√						√				
CO_3	√										
CO_4				√							

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2061	**Machine Tool Design**	SC	4	0	0	4	4

Prerequisite: Metrology & Measurements, Strength of Materials, Machine Design, Theory of Machines	Internal Assessment	Semester End Exam
	50 Marks	50 Marks

Course Objectives	1. To impart the fundamental notations of the machine tools including the different types, construction, applications and their technological capabilities. 2. To provide exposure to the systematic methods for solving the problems of designing machine tools and their components by exploring the various design aspects of machine tools elements like transmissions, structures, materials, kinematics, dynamics and construction of machine tools, etc.
Course Outcomes	After completion of the course the student will be able to 1. Analyze constructions and kinematic schemata of different types of machine tools. 2. Construct ray diagrams and speed spectrum diagrams for speed and feed box. 3. Develop the conceptual design, manufacturing framework and systematic analysis of design problems on the machine tools. 4. Apply the design procedures on different types of machine tool and/or machine tool components.

Unit:1	**Machine Tool Drive**	12 Hours

Machine Tool Drive: Working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General Requirements of machine tool design, Layout of machine tools.
Regulation of Speed and Feed Rates: Aim of speed feed regulation, Stepped regulation of speed, Design of speed box, Design of feed box, Special cases of gear box design, Set stopped regulation of speed and feed rates

Unit:2	**Design of Machine Tool Structure**	11 Hours

Design of Machine Tool Structure: Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Static and dynamic stiffness, Design of beds and columns, Design of housing models, Techniques in design of machine tool structure.

Unit:3	**Design of Guide-ways and power Screws**	11 Hours

Design of Guide-ways and power Screws: Function and type of guide-ways, Design of slide-ways, protecting devices for slide-ways, Design of power screws. Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.

Unit:4	**Cooling & Exhaust System**	11 Hours

Dynamics of Machines Tools: General procedure of assessing dynamic stability of EES, Cutting processing, closed loop system, Dynamic characteristics of cutting process, Stability analysis.

Text Books	**1. Machine Tool Design** by N.K. Mehta Tata McGraw Hill. **2. Machine Tool design Handbook** - CMTI Bangalore.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√						√				
CO_3	√										
CO_4						√					

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2062	**Mechatronics Product Design**	**SC**	4	0	0	4	4
Prerequisite: Automation, CAD/CAM, Engg. Mathematics, Basic Electronics, Mechatronics and Microprocessor			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To educate the student regarding integration of mechanical, electronics, electrical and computer systems in the design of CNC machine tools, Robots etc. 2. To provide students with an understanding of the Mechatronic Design Process, actuators, Sensors, transducers, Signal Conditioning, MEMS and Microsystems and also the Advanced Applications in Mechatronics
Course Outcomes	After completion of the course the student will be able to 1. Appreciate multi-disciplinary nature of modern engineering systems and specifically mechanical engineering students to collaborate with Electrical, Electronics, Instrumentation and Computer Engineering disciplines. 2. Analyze constructions and models of Engineering Systems, rotational, translation, elected mechanical, Hydraulic mechanical system. System Transfer functions. 3. Develop the conceptual design of Mechatronic Product using available software CAD packages MATLAB and SIMULINK 4. Apply the design procedures on different types of machine tool and/or machine tool components using mechatronics concept.

Unit:1	**Introduction to Mechatronics**	11 Hours

Introduction to Mechatronics: Systems and components: Principles of basic electronics - Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop.

Microprocessors and their applications: Microcomputer computer structure/micro controllers, Integrated circuits - signal conditioning processes, various types of amplifiers, low pass and high pass filters.

Unit:2	**Sensors**	12 Hours

Sensors -sensors and transducers. Displacement, position proximity sensors, velocity, force sensors. Fluid pressure temperature, liquid level and light sensors. Selection of sensors. Actuators, Pneumatic and hydraulic systems, Mechanical actuation system. Electrical actuation system. Other Electrical / Electronic hardware in Mechatronic system.

Unit:3	**Principles of Electronic system communication**	11 Hours

Principles of Electronic system communication, Interfacing, A.D and D.A Converters: Software and hardware principles and tools to build mechatronic systems. Basic system models mathematical models, mechanical and other system Building blocks.

System models: Engineering Systems, rotational, translation, elected mechanical, Hydraulic mechanical system. System Transfer functions.

Unit:4	**First-second order system in series**	11 Hours

First-second order system in series: Design and selection of Mechatronics systems namely sensors line encoders and revolvers, stepper and servomotors Ball screws, solenoids, line actuators and controllers with application to CNC system, robots, consumer electronics products etc, Design of a Mechatronic Product using available software CAD packages , MATLAB and SIMULINK.

Text Books	1. W.Bolton, Mechatronics, Addison Worley Longman Pvt. Ltd., India Brander, Delhi.
References	1. Mikel P Grooer , Automation Production System and CIMS, Prentice Hall of India Pvt. Ltd, New Delhi.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2063	**Rotor Dynamics**	SC	4	0	0	4	4
Prerequisite: Engg. Mathematics, Turbo Machines, Tribology, FEM, Mechanical Vibrations			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand Basic theory of fluid film lubrication, Derivation of generalized Reynolds equations, Boundary conditions, 2. 2. Provide systematic basic knowledge for Rayleigh's method, Stodola's method. Rotor Bearing System: Instability of rotors due to the effect of hydrodynamic oil layer in the bearings, 3. To enable the students to understand General turborotor system, development of element transfer matrices, the matrix differential equation 4. Formulate the General turborotor system, generalized forces and co-ordinates system assembly element matrices.
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of Fluid Film Lubrication& Flexible Shafts. 2. Formulate the Critical Speed: Dunkerley's method. 3. Determine the Turbo rotor System Stability by Transfer Matrix Formulation. 4. Derive the Turbo rotor System Stability by Finite Element Formulation.

Unit:1	**Fluid Film Lubrication &Flexible Shafts**	12 Hours

Fluid Film Lubrication: Basic theory of fluid film lubrication, Derivation of generalized Reynolds equations, Boundary conditions, Fluid film stiffness and Damping coefficients, Stability and dynamic response for hydrodynamic journal bearing, Two lobe journal bearings.

Stability of Flexible Shafts: Introduction, equation of motion of a flexible shaft with rigid support, Radial elastic friction forces, Rotary friction, friction Independent of velocity, friction dependent on frequency, Different shaft stiffness Constant, gyroscopic effects, Nonlinear problems of large deformation applied forces, instability of rotors in magnetic field.

Unit:2	**Critical Speed**	11Hours

Critical Speed: Dunkerley's method, Rayleigh's method, Stodola's method. Rotor Bearing System: Instability of rotors due to the effect of hydrodynamic oil layer in the bearings, support flexibility, Simple model with one concentrated mass at the centre.

Unit:3	**Turbo rotor System Stability by Transfer Matrix Formulation**	11 Hours

Turbo rotor System Stability by Transfer Matrix Formulation: General turborotor system, development of element transfer matrices, the matrix differential equation, effect of shear and rotary inertia, the elastic rotors supported in bearings, numerical solutions.

Unit:4	**Turbo rotor System Stability by Finite Element Formulation**	11 Hours

Turbo rotor System Stability by Finite Element Formulation: General turborotor system, generalized forces and co-ordinates system assembly element matrices, Consistent mass matrix formulation, Lumped mass model, linearized model for journal bearings, System dynamic equations Fix stability analysis non dimensional stability analysis, unbalance response and

Transient analysis. **Blade Vibration:** Centrifugal effect, Transfer matrix and Finite element, approaches.	
Text Books:	1. **Principles of Lubrication,** Cameron, Longman Publishing Group, 1986 2. **Non conservative problems of the Theory of elastic stability** Bolotin, Macmillan, 1963
References:	1. **Matrix Methods in Elasto Mechanics,** Peztel, Lockie, McGraw-Hill, 1963. 2. **Vibration Problems in Engineering,** Timosenko , Oxford City Press, 2011 3. **The finite element method in engineering science**, Zienkiewicz, McGraw-Hill, 1971

Mapping of Po's and Co's

Program outcomes Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2071	**Advanced Machine Design**	SC	4	0	0	4	4
Prerequisite: TOE, TOP and DME-1 and 2			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. Knowledge of different modes of failures & fatigue behavior of materials 2. To identify the Life estimation and stress component subjected to finite and infinite life. 3. Introduction to fracture mechanics and stress intensity factor. 4. Understand different damage tolerant theories used to estimate life and Types of surface failures, contact stresses.
Course Outcomes	At the end of the course, the student will be able to 1. Classify and explain the art of design methodology by analysis and damage tolerance methods. 2. Discuss an overview of mechanical behavior which includes tensile, fatigue and creep. 3. Illustrate the micro mechanisms of brittle and ductile fracture. 4. Examine the fatigue and fracture behavior of materials.

Unit:1	**Introduction and fatigue behavior of materials**	11 Hours

Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory, Numerical examples. Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods, Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features.

Unit:2	**Stress-life (S-N) approach and strain-life (ε-N) approach**	11 Hours

S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behavior, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach. Monotonic stress-strain behavior, Strain controlled test methods, Cyclic stress-strain behavior, Strain based approach to life estimation, Determination of strain life fatigue properties, mean stress effects, Effect of surface finish, Life estimation by S-N approach.

Unit:3	**Linear elastic fracture mechanics & residual stresses:**	11 Hours

LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects, Crack growth life estimation. Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, stress intensity approach.

Residual Stress: Introduction, production of residual stresses & fatigue resistance, relaxation of residual stresses, measurement of residual stresses, stress intensity factors for residual stresses, applications.

Unit:4	**Fatigue from variable amplitude loading**	12 Hours

Spectrum loads and cumulative damage, Damage quantification and the concepts of Damage fraction

and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach.	
Text Books	1. **Metal Fatigue in Engineering**, R. I. Stephens, A. Fatemi, R. R. Stephens, H. Fuchs, John Wiley Newyork, 2nd edition, 2001. 2. **Failure of Materials in Mechanical Design,** J. A. Collins, JWiley, Newyork, 1992. 3. **Machine Design,** R. L. Norton, Pearson Education India, 2000.
References	1. **Fatigue of Material**, S. Suresh, Cambridge University Press, 1998. 2. **Fundamentals of Metal Fatigue Analysis,** J. A. Benantine, Prentice Hall, 1990. 3. **Fatigue and Fracture,** ASM Hand Book, Vol 19, 2002.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3				√							
CO_4				√							

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2072	**Robotics and Its Application**	SC	4	0	0	4	4
Prerequisite: CAD/CAM/CIM			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	
Course Objectives	1. Learn the concepts of robot representation using concepts of kinematics & mathematics. 2. Learn & understand the Matrix Representation, Homogeneous transformation, forward and inverse Kinematics 3. Learn basic methods & algorithms of Trajectory planning: avoidance of obstacles uninformed path search. 4. Learn the Image processing Vs image analysis, image Acquisition.						
Course Outcomes	After Completion of the course student shall be able to: 1. Formulate the Mathematical representation of Robots, Kinematics of Robot 2. Determine the Trajectory planning 3. Understand the basic principle of Machine Vision systems, image acquisition & image components. 4. Apply the knowledge to design actual robots to perform basic operations such as pick & place line follower robots etc.						
Unit:1	**Introduction to Robotics &Types of joints**						12 Hours
Robotics Introduction: Basic Structure, Classification of robot and Robotic systems –laws of robotics – robot motions – work space, precision of movement. **Types of joints:** Rotary, prismatic, cylindrical & spherical joints. Position& orientation of rigid body, universal frames & fixed frames, Euler angle representation for xyz, zyz frames.							
Unit:2	**Mathematical representation of Robots, Kinematics of Robot**						12 Hours
Mathematical representation of Robots, Kinematics of Robot : Introduction, Matrix Representation, Homogeneous transformation, forward and inverse Kinematics, Inverse Kinematics Programming, Degeneracy, dexterity, transformation matrix for 3R manipulator, puma 560 & SCARA manipulator.							
Unit:3	**Trajectory planning**						11 Hours
Trajectory planning : avoidance of obstacles uninformed path search, informed path search, A* & B* algorithms, bus algorithms with tactile sensors & case studies							
Unit:4	**Machine Vision systems**						10 Hours
Machine Vision systems : Introduction – Image processing Vs image analysis, image Acquisition, digital Images – Sampling and Quantization – Image definition, levels of Computation							
Text Books	1. **Introduction to Robotics Analysis, Systems, Applications:** Saeed B. Niku, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)						
References	1. **Industrial Robotics Technology, Programming and Applications,** M.P. Groover McGraw-Hill, USA, 1986. 2. **Machine Vision:** Ramesh Jam, Rangachari Kasturi, Brain G. Schunck, Tata McGraw-Hill, 1991. 3. **Robotics for Engineers**, Yoremkoren, McGraw-Hill, USA, 1987. 4. **Robotics and Image Processing,** P.A. Janaki Raman, Tata McGraw-Hill, 1991.						

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1						√					
CO_2						√					
CO_3						√					
CO_4						√					

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD2073	**Optimization in Engineering Design**	SC	4	0	0	4	4

Prerequisite: Operation Research, Project Management, Optimization Techniques	Internal Assessment	Semester End Exam
	50 Marks	50 Marks

Course Objectives	1. It aims at finding out Engineering Design Practice and Applications of Optimization in Engineering Design 2. It provides the designer to , Design Variables and Design Constraints 3. It helps in solving the Gradient Based Optimization Methods – Dual and Direct. 4. It gives an idea about the Manufacturability in Optimization Problems
Course Outcomes	Upon Completion of the course student shall be able to: 1. Identify the fundamentals of Engineering Design Practice. 2. Test the Optimum Design Problem Formulation. 3. Detect the Gradient Based Optimization Methods. 4. Investigate the Manufacturability in Optimization Problems, Design Interpretation and Dynamic Programming.

Unit:1	**Engineering Design Practice**	12 Hours

Engineering Design Practice: Evolution of Design Technology, Introduction to Design and the Design Process, Design versus Analysis, Role of Computers in Design Cycle, Impact of CAE on Design, Numerical Modeling with FEA and Correlation with Physical Tests.

Applications of Optimization in Engineering Design: Automotive, Aerospace and General Industry Applications, Optimization of Metallic and Composite Structures, Minimization and Maximization Problems, MDO and MOO.

Unit:2	**Design Problem Formulation**	12 Hours

Optimum Design Problem Formulation: Types of Optimization Problems, The Mathematics of Optimization, Design Variables and Design Constraints, Feasible and Infeasible Designs, Equality and Inequality Constraints, Discrete and Continuous Optimization, Linear and Non Linear Optimization.

Optimization Theory – Fundamental Concepts, Global and Local Minimum, Gradient Vector and Hessian Matrix, Concept of Necessary and Sufficient Conditions, Constrained and Unconstrained Problems, Lagrange Multipliers and Kuhn Tucker Conditions.

Unit:3	**Gradient Based Optimization Methods**	11 Hours

Gradient Based Optimization Methods – Dual and Direct.

Optimization Disciplines: Conceptual Design Optimization and Design Fine Tuning, Combined Optimization, Optimization of Multiple Static and Dynamic Loads, Transient Simulations, Equivalent Static Load Methods. Internal and External Responses, Design Variables in Each Discipline.

Unit:4	**Manufacturability in Optimization Problems**	10 Hours

Manufacturability in Optimization Problems: Design For Manufacturing, Manufacturing Methods and Rules, Applying Manufacturing Constraints to Optimization Problems.

Design Interpretation: Unbound Problems, Over Constrained Problems, Problems with No of

Multiple Solutions, Active and Inactive Constraints, Constraint Violations and Constraint Screening, Design Move Limits, Local and Global Optimum . **Dynamic Programming:** Introduction, Multistage decision processes, Principle of optimality, Computational Procedure in dynamic programming, Initial value problem, Examples.	
Text Books	1. **Engineering Optimization: Theory and Practice**- S.S.Rao, John Wiley, 2009 2. **Introduction to Optimum Design-** JasbirArora, McGraw Hill, 2011.
References	1. **Optimization and Probability in System Engg** - Ram, Van Nostrand. 2. **Optimization methods** - K. V. Mital and C. Mohan, New age International Publishers, 1999. 3. **Optimization methods for Engg. Design** - R.L Fox, Addison – Wesley, 1971.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										√
CO_3	√										
CO_4	√										

THIRD SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD3010	**Fatigue and Fracture Mechanics**	HC	3	1	0	4	5
Prerequisite: Engg. Mathematics, TOE, TOP, MSM				Internal Assessment		Semester End Exam	
				50 Marks		50 Marks	

Course Objectives	1. To enable the students to understand the Fundamental Concepts, Historical perspective, Linear Elastic Fracture Mechanics. 2. Provide systematic basic knowledge for Crack-Tip-Opening Displacement, The J Contour integral, Relationships Between J and CTOD, 3. To enable the students to understand Ductile Fracture, Cleavage, the Ductile-Brittle Transition, and Intergranular Fracture. 4.Knowledge about the General Considerations, KIc Testing, K-R Curve Testing
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of Stress Analysis of Cracks, Relationship between K and G 2. Formulate the Elastic-Plastic Fracture Mechanics & Dynamic and Time-Dependent Fracture 3. Determine the Fracture Mechanisms in Metals& Non Metals 4. .Derive the Fracture Toughness, Testing of Metals & Non Metals

Unit:1	**Fundamental Concepts**	12 Hours

Fundamental Concepts: Introduction, Historical perspective, Linear Elastic Fracture Mechanics, An Atomic View of Fracture, Stress Concentration Effect of Flaws, The Griffith Energy Balance, The Energy Release Rate, Instability and the R Curve, Stress Analysis of Cracks, Relationship between K and G, Crack-Tip Plasticity, K-Controlled Fracture, Plane Strain Fracture, Mixed-Mode Fracture, Interaction of Multiple Cracks.

Unit:2	**Elastic-Plastic Fracture Mechanics & Dynamic and Time-Dependent Fracture**	12 Hours

Elastic-Plastic Fracture Mechanics: Crack-Tip-Opening Displacement, The J Contour integral, Relationships Between J and CTOD, Crack-Growth Resistance Curves, Controlled Fracture, Crack-Tip Constraint Under Large-Scale Yielding, Numerical problems.

Dynamic and Time-Dependent Fracture: Dynamic Fracture and Crack Arrest, Effect of fatigue on Creep Crack Growth, Viscoelastic Fracture Mechanics.

Unit:3	**Fracture Mechanisms in Metals& Non Metals**	11 Hours

Fracture Mechanisms in Metals: Ductile Fracture, Cleavage, the Ductile-Brittle Transition, and Intergranular Fracture.

Fracture Mechanisms in Non-metals: Engineering Plastics, Ceramics and Ceramic Composites, Micro crack Toughening, Concrete and Rock.

Unit:4	**Fracture Toughness Testing of Metals& Non Metals**	10 Hours

Fracture Toughness Testing of Metals: General Considerations, KIc Testing, K-R Curve Testing, J Testing of Metals, CTOD Testing, Dynamic and Crack-Arrest Toughness, Fracture Testing of

Weldments, Testing and Analysis of Steels in the Ductile-Brittle Transition Region, Qualitative Toughness Tests, Numerical problems. **Fracture Testing of Non-metals:** Fracture Toughness Measurements in Engineering Plastics, Precracking and Other Practical Matters, Inter laminar Toughness of Composites, Ceramics.	
Text Books	1. **Fracture Mechanics:** Fundamentals and Applications by T.L. Anderson, CRC Press, Florida
References	1. **Elementary Engineering Fracture Mechanics** by D. Broek, MartinusNijhoff. 2. **The Practical Use of Fracture Mechanics** by D. Broek, Kluwer Academic Publishers. 3. **Deformation and Fracture Mechanics of Engg. Materials** by R. W. Hertzberg, John-Wiley & Sons. 4. **Fracture and Fatigue Control in Structures:** Applications of fracture mechanics by J.M. Barsom and S.T. Rolfe, ASTM International. 5. **Mechanics and Mechanisms of Fracture**: An Introduction by A. F. Liu,ASTM International.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD3020	**Modern Automotive System**	OE	4	0	0	4	4
Prerequisite: IC Engines, Turbo Machines ,Automobile Engineering			Internal Assessment			Semester End Exam	
			50 Marks			50 Marks	

Course Objectives	1. To enable the students to understand Aerodynamic Shapes, drag forces for small family cars 2. Provide systematic basic knowledge of Combustion fundamentals, combustion chamber design 3. To enable the students to understand Design of transmission systems – gearbox 4. Formulate the to understand the basic principles of Heat exchangers, application to design of cooling system
Course Outcomes	After completion of the course the student will be able to 1. Demonstrate the fundamentals of Body Shapes & Fuel Injection 2. Formulate design for both SI & C. I. Engines. 3. Determine the Transmission &Suspension System 4. Describe the Cooling & Exhaust System and Emission Control

Unit:1	**Body Shapes & Fuel Injection**	12 Hours

Body Shapes: Aerodynamic Shapes, drag forces for small family cars.
Fuel Injection: Spray formation, direct injection for single cylinder engines (both SI & CI), and energy audit.

Unit:2	**Design of I.C. Engine**	12 Hours

Design of I.C. Engine I: Combustion fundamentals, combustion chamber design, cylinder head design for both SI & C. I. Engines.
Design of I.C. Engine II: Design of crankshaft, camshaft, connecting rod, piston & piston rings for small family cars (max up to 3 cylinders).

Unit:3	**Transmission &Suspension System**	11 Hours

Transmission System: Design of transmission systems – gearbox (max of 4-speeds), differential.
Suspension System: Vibration fundamentals, vibration analysis (single & two degree of freedom, vibration due to engine unbalance, application to vehicle suspension.

Unit:4	**Cooling & Exhaust System**	10 Hours

Cooling System: Heat exchangers, application to design of cooling system (water cooled).
Emission Control: Common emission control systems, measurement of missions, exhaust gas emission testing.

Text Books	1. **Design of Automotive Engines**, - A .Kolchin& V. Demidov, MIR Publishers, Moscow 2. **The motor vehicle,** Newton steeds &Garratte- Iliffee& sons Ltd., London 3. **I.C. Engines** - Edward F Obert, International text book company.
References	1. **Introduction to combustion**- Turns 2. **Automobile Mechanic** -,N.K.Giri, Khanna Publications, 1994 3. **I.C. Engines** -Maleev, McGraw Hill book company, 1976

	4. **Diesel Engine Design** -HeldtP.M.,Chilton company New York. 5. **Problems on design of machine elements** -V.M. Faires&Wingreen, McMillan Company., 1965 6. **Design of I.C.Engines** -John Heywood, TMH

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√										
CO_2	√										
CO_3	√										
CO_4	√										

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD3030	**Internship With Report**	RULO	0	0	6	6	12
Prerequisite: Mechanical Vibrations, Automotive Engineering							
Course Objectives	1. To give exposure to industrial activities. 2. To learn various aspects of activities carried out in industry. 3. To understand application of concepts of mechanical engineering in industry. 4. To know various process and machines used to make a product. 5. To gain overall idea about industry.						
Course Outcomes	After completion of the course the student will be able to 1. Explain various aspects of industry working principle and culture. 2. Understanding of the respective company methods and process used to make a product. 3. Explain the management philosophy and concept used in particular industry. 4. Explain the activities of the particular industry and adopting of the concept for entrepreneurship.						
Student should undergo internship for 21 days in one stretch or 15 days in two stretches at the end of the 3rd semester. After completion, submit the 20 page report on internship and give presentation which will be evaluated as per the university guidelines.							

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√						√				
CO_2	√						√				
CO_3	√						√				
CO_4	√						√				

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD3040	**Project Phase-I**	HC	0	0	4	4	8
Prerequisite: All previous courses taught in earlier semesters							
Course Objectives	1. To identify the problem in real time application and find out the solution 2. To make the students to convert their ideas in to reality. 3. To develop the skill of writing, documentation and presentation						
Course Outcomes	After completion of the course the student will be able to 1. Identify the problems in the real time application. 2. Apply the knowledge to analyze the problem. 3. Document the progression of the work and results. 4. Design the process/ product for simple applications.						
The student have to start project and select the problems which is relevant to an industry or in the society or any innovative ideas. In project phase-I student has to work for the literature work and problems has to be clearly defined at the end semester and present the progress of the work in two phases which will be evaluated. At the end of the semester the students have to submit the hard copy of the report which will be prepared as per the guidelines/format of the university. Semester end evaluation will be conducted for each student.							

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1	√						√				
CO_2	√						√				
CO_3	√						√				
CO_4	√						√				

Course Code	Course Title	Course Type	L	T	P	C	Hrs./ Wk.
M18MD3050	MUSIC / DANCE / SPORTS / THEATER / YOGA	RULO	0	0	2	2	2

Note: Music, Dance, and Theater courses are offered by the School of Performing Arts, whereas the Sports and Yoga courses are offered by the Department of Physical Education. The students have to choose any **ONE** of these courses.

A. YOGA FOR HEALTH

Course Objectives:

Following are the Course Objectives.

- To prepare the students for the integration of their physical, mental and spiritual faculties;
- To enable the students to maintain good health;
- To practice mental hygiene and to attain higher level of consciousness;
- To possess emotional stability, self control and concentration; and
- To inculcate among students self discipline, moral and ethical values.

Course Outcomes:

On completion of the course learners will be able to:

- Practice yoga for strength, flexibility, and relaxation.
- Learn techniques for increasing concentration and decreasing anxiety
- Become self disciplined and self-controlled
- Improve physical fitness and perform better in studies
- Gain self confidence to face the challenges in the society with commitment to serve the society

Course Contents

Unit-I:

Yoga: Introduction, Tips from Sage Patanjali's Yoga Sutras
Surya Namaskara:- 10 counts,12 counts,16 counts

Unit-II:

Asanas: Sitting- Vajrasana, Dandasana, Padmasana, Matsyasana, Ardha Matsyendrasana, Suptavajrasana, Paschimottasana, Bakasana, Simhasana, Shirasasana.
Asanas: Standing- Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana, Parivrutta trikonasana.

Unit-III:

Asanas: Prone Position- Bhujangasana, Dhanurasana, Shalabhasana.

Asanas: Supine Position- Sarvangasana, Sethubandha sarvangasana, Halasana, Karnapeedasana.

Mudras- Dhyana mudra, Chinmaya mudra, Namaste mudra, Nasika mudra

Unit-IV:

Pranayams:- Ujjayi, Nadi Shodhana, Anuloma – Viloma, Basthrika, Bhramari, Sheethali

Dhyana & its types

Competition format, Rules and their interpretations

B. SPORTS (VOLLEYBALL)

Course Objectives:

1. To learn the rules, fundamental skills, and strategies of volleyball.
2. To develop skills in passing, setting, serving, spiking, and blocking.
3. To learn basic offensive and defensive patterns of play.
4. To develop a positive attitude towards volleyball as a lifetime sport and to improve physical fitness through participation in volleyball.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with volleyball.
2. Apply these skills while playing volleyball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Contents:

Unit-I

- Introduction about Volleyball
- Players Stance, Receiving and passing
- The Volley (Overhead pass), The Dig (Underhand pass), Service Reception

Unit-II

- Service- Under Arm Service, Tennis Service, Side Arm Spin Service, Round Arm Service, High spin service, Asian serve / American serve (floating)
- Setting the ball- Set for attack, Back set, Jump set

Unit-III

- Smash/Spike- Straight smash, Body turn smash, Wrist outward smash, Wrist inward smash
- Block- Single block, Double block, Three-man block

- Rolls- Overhead pass & back rolling, One hand underhand pass with side rolling, Forward dive

Unit-IV

- Attack Combination, Defense Systems, Libero play
- Court marking, Rules and their interpretations and Duties of officials

C. SPORTS (BASKETBALL)

Course Objectives:

1. To learn the rules, fundamental skills, and strategies of Basketball
2. To develop technical skills in passing, in ball handling, individual offense, individual defense, rebounding, screen, team offense, team defense and fast break.
3. To learn basic offensive and defensive strategies of play.
4. To develop a positive attitude towards Basketball as a lifetime sport and to improve physical fitness through participation in Basketball.
5. To develop positive understanding and appreciation of the basketball game.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with basketball.
2. Apply these skills while playing basketball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Contents:

Unit-I

- Basketball: Introduction
- Grip; Player stance- Triple threat stance and Ball handling exercises
- Passing (Two hand/one hand)- Chest pass, Bounce Pass, Over head pass, Underhand pass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running.
- Receiving-Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving while jumping, Receiving while running.

Unit-II

- Dribbling- How to start dribble, How to stop dribble, High / Low dribble with variations
- Shooting- Layup shot and its variations, One hand set shot, One hand jump shot, Free throw, Hook shot, Tip-in shot.

- Stopping- Stride/Scoot, Pivoting and Faking /Feinting footwork.

Unit-III

- Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.
- Individual Defensive- Guarding the man with the ball and without the ball.
- Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

Unit-IV

- Court marking, Rules and their interpretations

D. SPORTS (FOOTBALL)

Course Objectives:

1. To learn the rules, fundamental skills, and strategies of football.
2. To develop skills in passing, receiving, controlling the ball, dribbling, shielding, shooting, tackling, beating a defender and heading in football.
3. To learn basic offensive and defensive patterns of play
4. To use different parts of the body in utilizing the above skills while playing football
5. To develop a positive attitude towards football as a lifetime sport and to improve physical fitness through participation in football.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with football.
2. Apply these skills while playing football and exhibit improved performance
3. Use the knowledge and understanding to perform, refine and adapt the above skills and related skills with precision, accuracy, fluency and clarity in any situation.
4. Improve physical fitness and practice positive personal and lifestyle.
5. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Content:

Unit-I

Football: Introduction

Kicks- Inside kick, Instep kick, Outer instep kick, Lofted kick, Chipping, Volley, Half Volley

Trapping- Trapping rolling the ball, Trapping bouncing ball with sole

Unit-II

- Dribbling- With instep and outer instep of the foot.

- Heading- From standing, running and jumping.
- Feinting- With the lower limb and upper part of the body.
-

Unit-III

- Tackling- Simple tackling, Slide tackling.
- Throw-in- Standing and Sliding
- Goal Keeping- Collection of balls, Ball clearance, throwing and deflecting.

Unit-IV

- Ground marking, Rules and their interpretations

E. SPORTS (TRACK AND FIELD)

Course Objectives:

1. To teach students the skilled techniques in sprints, relay running, hurdles, long jump, high jump, and shot put and practice them.
2. To develop competence among students in demonstrating all the techniques covered in the course.
3. To make students understand some of the scientific and empirical principles and their rationale underlying the development of skilled performance.
4. To inculcate among students the habit of team work and cooperative learning and develop competence in detecting / correcting technique errors.
5. To develop a positive attitude towards sports in general and athletics in particular and to improve physical fitness through participation in various athletic games / sports activities.

Course Outcomes:

On completion of the course learners will be able to:

1. Display competencies in executing basic techniques and skills associated with select track and field events.
2. Develop basic skills and techniques to improve one's running posture and take-off position for different jumps.
3. Learn regular practice of select track and field events and improve physical fitness
4. Appreciate track and field events by applying sports science knowledge to explain the execution of the events.

Course Content:

Unit-I

Athletics: Introduction
Track Events - Steeple Chase, Race Walking, Middle and Long distance races
Race walking - Technique, Faults and Officiating.
Middle and Long distance races – Technique and Training

Unit-II

Jumping Events - High Jump and Triple Jump: Basic Skills and techniques
High Jump - Straddle Roll & Flop Technique, Approach, Take-off, Technique in the air, Clearance over the bar & Landing
Triple Jump – Hop, Step and Jump Technique, Approach, Take-off & Landing

Unit-III

Throwing Events - Discus Throw and Hammer Throw: Basic Skills and techniques
Discus Throw - Standing and Rotatory techniques, Grip, Stance, Rotation Technique, Power stance, Release and Reverse (Follow through)
Hammer Throw - Grip, Swings, Rotation foot work, Release and Follow through

Unit-IV

Rules, Officiating and Marking - Ground / Sector Marking, Interpretation of Rules.

Reference Books

(Athletics Part-I and Athletics Part-II)

1. Arthur E. Ellison (ed) (1994). Athletic Training and Sports Medicine.
2. Ballisteros, J.M. (1998). Hurdles Basic Coaching Manual, IAAF.
3. Bosen K.O. (1993). Teaching Athletics Skills and Technique.
4. Bosen K.O. (1990). Study Material on Hurdles for the Regular Course Students.
5. Doherty K. (1995). Track and Field Omni book.
6. Martin, David E. Peter N. Coe (1991). Training Distance Runner.
7. Howard S. (1981). Science of Track and Field Athletics.
8. Briggs Graeme (1987). “Track and field coaching Manual”, Australian Track and Field Coaches Association. Rothmans Foundation National Sports Division.
9. Carr, Gerry (1999). “Fundamentals of Track and Field. Track Athletics 1 Title G.V. 1060 5.e. 368.
10. I.A.A.F. Level-II (2001). Text Book on Jumping Event.
11. Jarver, Jesse (1987). “The Jumps”, Track and Field Coaching Manual Australia.

F. DRAMATICS

Pre-requisites: Students with background in Theatre Arts/ Keen interest in Dramatics.

Course Objectives:

- •To imbibe the acting skills.
- •To understand the broader applications of theatre studies in allied arts forms.
- •To be able to use body language for better communication.
- • Students shall also be able to understand voice modulation and Navarasas.

Course Outcomes:

On successful completion of this course, students should be able to:

- • Freely express improvisation in non-verbal communication.
- • Shall hone good acting skills and be able to emote better.
- • Be able to put up a theatre act and play a key role.
- • Be able to differentiate good acting and understand the importance of good lyrics, stage crafting, music, dance, costume and lighting.

Course Content:

UNIT – 1

Working on Body:

Body and its analysis. Understanding physical abilities (Anga, Pratyanga and Upanga). Challenges of the body. Using body as metaphor and language. The class's bodies as a collective, an ensemble, a collaborative team.

UNIT – 2

Sound and Movement:

Awareness of creating sound patterns, voice modulations, rhythm in speech and diaologues. Understanding the rhythm and patterns of movements like walking, framing, shaping, primitive and animal movements.

UNIT – 3

Characterization and Improvisation:

Observation of people around. Getting into the role and living it. Developing a character from establishment (pace and rhythm). Improvisation techniques of body and mind.

UNIT – 4

Group work and Production:

Develop a theme, concept or a play and include all the theatre skills, stage craft, costuming and put up an act. Choosing theme and characters.

Reference Books:

1. All about Theatre – Off stage – Chris Hogget.
2. Rangadalli Anataranga – K V Subbanna
3. The Indian Theatre – Hemendranath Das Gupta.
4. A Practical handbook for an Actor – Milisa Bruder, ee Milchel Cohn, Madeleine Oliek et al, Zigler Publisher.

G. INDIAN CLASSICAL DANCE FORMS (Bharathanatyam, Kuchipudi ,Mohiniyattam)

Prerequisites: Background of classical dance training or any other dance forms.

Note: Non-classical dancers can also join.

Course Objectives:

- To develop an understanding about the Indian classical dance forms and its universal application.
- To be able to understand the fine nuances of Classical dance.
- To understand the importance of health through Indian classical dance, strengthen the body capacity.
- To understand mythology and its characters in Indian classical dance form through lessons of Abhinaya.

Course Outcomes:

- To be able to identify and appreciate the classical dance forms.
- To be able to execute basics of Adavus with finesse.
- To be able to express through abhinaya.
- To be able to perform to perform the fundamentals in the chosen dance form.

Course Content:

Unit 1

An introduction to Indian classical dance forms: Bharatanatyam, Kuchipudi, Mohiniyattam.

Unit 2

Learning of Fundamentals: Exercises and Adavus- I (Bharathanatyam, Kuchipudi, Mohiniyattam).

Unit 3

Adavus –II (Bharathanatyam, Kuchipudi, Mohiniyattam)

Unit 4

Learn a basic composition in the chosen dance form.

Reference Books:

1. Indian classical dance forms –U S Krishna Rao,U K Chandrabhaga Devi
2. Classical Dances –Sonal Mansingh, Avinash Parischa
3. Kuchipudi – Sunil Kothari
4. Bharatanatyam An in depth study- Saroja vydyanathan
5. Mohiniyattam – Bharathi Shivaji

H. PERCUSSION INSTRUMENT (TABLA AND MRIDANGAM)

Pre-requisites: Students with background in Percussion instruments and knowledge of Rhythm/ Keen interest in studying Mridagam / Tabala.

Course Objectives:

- •To understand the Rhythmology.
- •To understand the importance of Laya, Taala.
- •To be able to understand the fine finger techniques of playing the instrument.

Course Outcomes:

On successful completion of this course, students should be able to:

- • To be able to set instrument to Sruthi.
- • To be able to play the fundamentals on instrument.
- • To be able to learn and perform a particular taala.

Course Content:

UNIT 1

1. Introduction to Musical Instruments
2. Percussion Instruments
3. Mridangam and its History

UNIT 2

1. Introduction to Tala System
2. Definitions of 5 jaathis and their recitation
3. Adi Talam and its various forms
4. Definitions and recitation of different gathis

UNIT 3

1. Tisra Jaathi
2. Khanda Jaathi
3. Misra jaathi
4. Sankeerna Jaathi

UNIT 4

1. Learning of Jathi Formation
2. Basic jathis
3. Jathis for Dance forms
4. Some Basic Definitions of Korvai, Teermanam etc.,

Reference Books:

1. Mridangam- An Indian Classical Percussion Drum – Shreejayanthi Gopal
2. Theory and practice of Tabala – Sadanand Naimpally.
3. Theory and practice of Mridangam – Dharmala Rama Murthy

4. The Art of the Indian Tabala – Srdjan Beronja.

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1								√			√
CO_2								√			√
CO_3								√			√
CO_4								√			√

FOURTH SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD4010	**Project/Dissertation**	HC	0	0	16	16	---
Prerequisite: All previous courses taught in earlier semesters							
Course Objectives	1. To identify the problem in real time application and find out the solution 2. To make the students to convert their ideas in to reality. 3. To develop the skill of writing, documentation and presentation.						
Course Outcomes	After completion of the course the student will be able to 1. Identify the problems in the real time application. 2. Apply the knowledge to analyze the problem. 3. Document the progress of the work and results. 4. Design the process/ product for simple applications.						
The student have to continue the project which he has started the problems in 3rd Sem from an industry or in the society or any innovative ideas. Student has to work for the solution or converting their ideas into product and present the progress of the work in two phases which will be evaluated. At the end of the semester the students have to submit the hard copy of the report which will be prepared as per the guidelines/format of the university. Semester end evaluation and vivo-voce will be conducted for each student.							

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1							√				√
CO_2							√				√
CO_3							√				√
CO_4							√				√

Course Code	Course Title	Course Type	L	T	P	C	Hr
M18MD4020	MOOC/ SWAYAM/ On line program	RULO	4	0	0	4	---
Prerequisite: All previous courses taught in earlier semesters							
Course Objectives	1. To provide an affordable and flexible way to learn new skills, 2. To advance the career 3. To deliver quality educational experiences at scale						
Course Outcomes	After completion of the course the student will be able to 1. Understand the advanced technologies through an expert online 2. Apply newest technologies to mechanical applications						

Note: Students shall choose to take up any online course of four credits as guided by the school or shall have to undergo internship of four weeks duration, the details of which are provided here under.

MOOC/ SWAYAM:

Globally, MOOC (Massive Open Online Course) platforms are gaining much popularity. Considering the popularity and relevance of MOOCs, Government of India has also launched an indigenous platform, SWAYAM. SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) is basically an integrated MOOCs platform for distance education that is aimed at offering all the courses from school level (Class IX) to post-graduation level. The platform has been developed collaboratively by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) with the help of Microsoft and is capable of hosting 2,000 courses.

A student shall register and successfully complete any of the courses available on SWAYAM.
Student shall inform the MOOC/SWAYAM coordinator of the school about the course to which he/she has enrolled. The minimum duration of the course shall be not less than 40 hours and of 4 credits. The student should submit the certificate issued by the SWAYAM to the MOOC/SWAYAM coordinator of the school, the grades obtained in the course shall be forwarded to concerned authority of the University.

List of some MOOC Centre:

1. Edx
2. Coursera
3. NPTEL
4. Swayam
5. Khan academy
6. Udacity

7. Udemy
8. Stanford online
9. WizIq

Mapping of Po's and Co's

Program outcomes / Course outcomes	PO_1 (a)	PO_2 (b)	PO_3 (c)	PO_4 (d)	PO_5 (e)	PO_6 (f)	PO_7 (g)	PO_8 (h)	PO_9 (i)	PO_{10} (j)	PO_{11} (k)
CO_1										√	√
CO_2										√	√

Career Development and Placement

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Machine Design is not only the knowledge in the subject, but also the skill to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second

semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his / her interest and march forward to make better career. The School of Mechanical Engineering also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU's with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF LEGAL STUDIES

HANDBOOK

for

BBA LL.B (Hons)

Approved by
RU/BoS/2016-17/25-04-2016
Batch: 2016-2021

Rukmini Knowledge Park,
Kattigenahalli,Yelahanka, Bangalore-560064
Phone No: +91-080-66226622, Fax: 080-28478539

Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr. S. Y. Kulkarni

Vice-Chancellor, REVA University

PREFACE

At his best, man is the noblest of all animals; separated from law and justice he is the worst.

- Aristotle

Ubi jus ibi remedium, where there is right there is remedy. Law is a powerful tool for bringing positive social change. The duty of legal professionals is to identify the rights and seek the remedies to make the real promise of "equal justice". The privilege of being a part of the legal profession compels us to promote the rule of law and its commitment to justice and equality.

Today, the best legal education must include an integration of theory, doctrine, and practice and must be delivered by a diverse faculty to a diverse student body. Legal education is no longer restricted to the traditional core subjects but it has interaction with public policy, business, information technology, bio medical technology, socio-political issues, ethical issues, cyber space environmental issues among others. The scope of legal education again is transgressing to international realm and providing a global perspective to students is a must.

Our school's commitment is to provide all round excellence to make our students adept to chart their own paths through unique programs that cross traditional disciplinary boundaries and provide opportunities to learn by doing. At REVA School of Legal Studies, students will not just learn to practice law, but they would learn to shape it. It is our aim to inculcate rigorous analytical skills needed as practitioner or as a Stewart of social, political and legal change. We aspire to prepare future leaders, lawyers, legal journalists, managers, business heads to serve their clients, the justice system and the public with a high level of accomplishment and a commitment to the highest ideals of the legal profession. We recognize the essential role of human creativity, intelligence, and initiative in education and therefore we strive to channelize the energies of our students for productive and creative purposes to develop their professional capacity. As a law school, we are committed to a healthy and respectful environment of free intellectual inquiry and exchange, and the protection of freedom of thought.

BBA LL.B program is designed keeping in view the current demographic need highlighted above and possible future developments, both at national and global levels. The course is a unique amalgamation of two professional degrees BBA and LLB and therefore provides an edge to our students for their future endeavour. While students will learn intricacies of business, they will be equally well-versed in nuances of regulatory affairs and corporate laws. The scheme of instruction and curriculum is prepared by the Board of Studies consisting of notable scholars, academicians, lawyers, legal experts specialized in the field. Greater emphasis is laid on the practical aspects of legal education, internships, tutorials etc. School of Legal Studies intends to measure student's growth and development in the area of legal reasoning, analytical skills, refinement and conceptualization, assimilation of large amount of data and

acquisition of the breadth of understanding and depth in the areas that interest the students most. Students will have access to various electives and this flexibility will be supported by a rigorous core program involving theory, study of doctrines, case-laws, case studies and practical training involving writing of research reports, internships, moots etc. The curriculum caters to and has a relevance's to local, regional, national and global developmental needs. Maximum number of courses are integrated with cross-cutting issues with relevance's to professional ethics, gender, human values, environment and sustainability. This program is under CBCS and CAGP system where students have the opportunity to choose the subjects of their choice from wide era of subjects as soft core study and open elective.

The personal and professional interests in the above course are matched by our faculty's discipline-leading research providing manifestation of contemporary issues throughout the study period. Our well-qualified, experienced and committed faculty will guide you, monitor your progress, mould you and make your study interesting and fruitful. Exciting opportunities will be available to students to expand their practical know-how in the field through internships, judicial clerkships, participation on moot-courts, MUN's among others. The facilities for curricular and co-curricular activities in REVA University with dedicated supportive staff provide you conducive ambience for learning. The University fully understands that engagement with professionally relevant aspects in Business Administration as well as Legal Studies is what will make our graduates sought after future leaders in their respective fields.

I am sure the students choosing BA LLB in REVA University will enjoy the curriculum, learning environment as well as make the best use of the vast infrastructure and experienced teacher's guidance. We will strive to provide all needed comfort and congenial environment for your studies. I wish all students pleasant stay in REVA and grand success in their career.

Dr. M L Kalicharan
Director, School of Legal Studies

CONTENTS

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. **Rukmini Educational Charitable Trust** (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 11,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer center, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 12000+ students studying in various branches of knowledge at graduate and post graduate level and 302 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed

input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre

conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is 'Life Time Achievement Award' to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the "Founders' Day Celebration" of REVA University in presence of

dignitaries, faculty members and students gathering and the first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO on the occasion of Founder's Day Celebration, 6th January, 2016 and the second "REVA Life Time Achievement Award" for the year 2016 has been awarded to Shri. Shekhar Gupta, Renowned Journalist on the occasion of Founder's Day Celebration, 6th January, 2017.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organises yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honoured with many more such honors and recognitions.

ABOUT SCHOOL OF LEGAL STUDIES

The School of Legal Studies has experienced faculty members specialized in Law and Business Administration and supported by well experienced professors, legal experts and practicing advocates as visiting faculty members. The school has the state-of-art class rooms and well equipped laboratories, drawing and seminar halls. The school offers B.A., LL.B and B.B.A., LL.B programs and aims to offer many courses with specializations at bachelors and masters level. The curriculum of graduate degree program has been designed to bridge the gap between judiciary, industry and academia and hence they are practical oriented. The B.A., LL.B and B.B.A., LL.B programs aim to prepare human resources to play a leading role in the competitive Legal Studies excel in their endeavors. The programs also focus on specialized and allied fields like environmental law, cyber law, taxation law, banking and insurance law, international trade law, intellectual property law etc., to enable students to prepare themselves to face confidently the challenges of present and future dynamic society and become successful leaders in legal profession.

VISION

"To achieve excellence in educating professionals, advancing legal scholarship, serving the public, fostering justice and the well-being of society"

MISSION

To provide quality legal education at bachelors and masters level through technologically advanced learning resources and a highly respected and experienced faculty to prepare our students to succeed in a dynamic and ever-evolving legal and business environment and to do research to contribute to the advancement of justice

OBJECTIVES

- Educate graduates who will be excellent professionals: knowledgeable, innovative, thoughtful, practical, ethical, and well-prepared for the practice of law;
- Engage with the community and the University at all levels of our work, including teaching, scholarship, public service, and public policy;
- Create and disseminate knowledge to solve social and legal problems and to promote justice;
- Integrate programs of instruction that connect skills and knowledge, apply theory to practice, and respect and engage diverse points of view and diverse experiences;
- Produce graduates of high quality scholarship, enhance our national and international stature,

attract excellent students, and take our place among the very best providers of legal education.

Core Values

- Respect the rights, differences, and dignity of others;
- Maintain Honesty and integrity in all dealings;
- Strive continuously for pursuit of excellence;
- Encourage innovative and effective teaching and learning;
- Create disseminate, and apply knowledge for advancement of legal profession;
- Contribute to a just society;
- Promote improvement of the legal system;
- Build and maintain strong connections with the legal community;
- Encourage productive involvement with the University and the broader community.

ADVISORY BOARD

Sl. No	Name & Designation	e-mail and Contact Number
1	Prof. V.B. Coutinho, Former Vice-Chancellor, Gulbarga University	venitcoutinho@gmail.com 09311263035
2	Prof. T. Ramakrishna National Law School University, Bangalore	Ramakrishna@nls.ac.in ramipr@gmail.com 0886383353
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Brief Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for FIVE Year Law Degree Programs

1. Teaching and Learning Process:

The five year B.A., LL.B and B.B.A LL.B programs comprise of various courses stipulated by the concerned Board of Studies. Each of the courses offered under both the programs will have three components associated with the teaching-learning process, namely:

(i) L= Lecture (ii) T= Tutorial (iii) P=Practice; where:

L stands for **Lecture** session consisting of classroom instruction.

T stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for **Practice** session and it consists of hands on experience / laboratory experiments / field **s**tudies / case studies that equip students to acquire the much required skill component.

2. Courses of Study and Credits

2.1 The study of various subjects in Law degree programs are grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

2.1.1 In terms of credits, every **one hour session of L amounts to 1 credit per Semester** and a minimum of **two hour session of T or P amounts to 1 credit per Semester or a three hour session of T or P amounts to 2 credits** over a period of one Semester of 16 weeks for teaching-learning process.

2.1.2 The total duration of a semester is 20 weeks inclusive of semester-end examination.

2.1.3 A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

2.2. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P. **The credit pattern of the course is indicated as L: T: P.**

2.2.1. If a course is of 4 credits then the different credit distribution patterns in L: T: P format could be:

4 : 0 : 0, 1 : 2 : 1, 1 : 1 : 2, 1 : 0 : 3, 1 : 3 :0,

2 : 1 : 1, 2 : 2 : 0, 2 : 0 : 2, 3 : 1 : 0, 3 : 0:1,

0 : 2 : 2, 0 : 4 : 0, 0 : 0 : 4, 0 : 1 : 3, 0 :3: 1,

2.2.2 The concerned BOS will choose the convenient Credit Pattern for every course based on the requirement. However, generally, a course shall be of FOUR Credits and occasionally may be of TWO Credits

Different C**ourses of Study** are labeled and defined as follows:

a. Core Course:

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. Foundation Course (FC):

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

c. Hard Core Course (HC):

The **Hard Core Course** is a Core Course in the main branch of study and related branches of study, if any that the candidates have to complete compulsorily.

d. Soft Core Course (SC):

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

e. O**pen Elective Course:**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an O**pen Elective Course.**

f. Project Work / Dissertation:

Project Work / Dissertation is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A project work carrying **FOUR or SIX** credits is called **Minor Project** work / **Dissertation.** A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called **Major Project** work / **Dissertation**. **A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned. But the Major Project shall be Hard Core.**

3. Duration of the programme and medium of instruction

3.1. The Duration of the programme shall be **FIVE academic years** comprising of **TEN semesters** and shall consist of 20 weeks duration including examination days.

3.2. A candidate who successfully completes 10 semesters and earns required number of credits shall be eligible for the award of B.A., LL.B / B.B.A., LL.B. A candidate can avail a maximum of 20 semesters – 10 years as per double duration norm, in one stretch to complete Law degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he / she has to study the prevailing courses offered by the School when he/she resumes his / her studies.

4. Eligibility for Admission

i. An applicant seeking admission to the B.A., LL.B. Degree Course shall have successfully completed Pre-University Course or Senior Secondary School course (10+2) or equivalent (such as 11+1, 'A' level in Senior School Leaving Certificate Course from a recognized University in India or outside, or from a Senior Secondary Board or equivalent, constituted or recognized by the Union or by a State Government or from any equivalent institution from a foreign country recognized by the government of that country for the purpose of issue of quality certificate on successful completion of the course, securing in aggregate not less than 45% (in the case of SC/ST 40%, 43% for OBC) of the total marks.

ii. Provided that applicants who have obtained 10+2 higher education passed certificate or First Degree Certificate after prosecuting studies in distance or correspondence method shall also be considered as eligible for admission in the integrated Five years Course.

(Explanation: The applicants who have obtained 10+2 or graduation / post-graduation through open universities system directly without having any basic qualification for prosecuting such studies are not eligible for admission in the law courses).

4.1 Age on admission:

(a) Subject to the condition stipulated by a University on this behalf and the high degree of professional commitment required, the maximum age for seeking admission into a stream of integrated Bachelor of law degree program, is limited to **twenty years** in case of general category of applicants and to **twenty two** years in case of applicants from SC, ST and other Backward communities.

(b) Subject to the condition stipulated by a University, and the general social condition of the applicants seeking legal education belatedly, the maximum age for seeking

admission into a stream of Three Year Bachelor Degree Course in Law, is limited to thirty years with right of the University to give concession of 5 further year for the applicant belonging to SC or ST or any other Backward Community.

4.2. Prohibition to register for two regular courses of study

No student shall be allowed to simultaneously register for a law degree program with any other graduate or postgraduate or certificate course run by REVA University or any other University or an Institute for academic or professional learning excepting in the integrated degree program of the REVA University. Provided that any short period part time certificate course on language, computer science or computer application of an Institute or any course run by a Centre for Distance Learning of a University however, shall be accepted.

4.3. Students Intake

i. Students' intake and admission will be as approved by Bar Council of India and Govt. of Karnataka.
ii. No Student shall be allowed to simultaneously register for any other graduate or degree programme during the course of the B.A., LL.B./B.B.A, LL.B, Programme

4.4. Prohibition of Lateral Entry or Exit

i. There shall be no lateral entry or exit. However, migration from similar programme of other Universities to the 3rd, 5th, 7th and 9th semesters is permissible subject to passing of the required courses of study of earlier semesters.

5. Scheme of Instruction and Training

i. Hours of instruction per course per week shall be 4 + 1 hours conducted in day hours and the total number of class hours per week including tutorials, moot court exercises and seminars shall be 30 hours.
ii. Each registered student shall have completed a minimum of 20 weeks of internship during the entire period of legal studies (at least 4 weeks in each year) under NGO, Trial and Appellate Advocates, Judiciary, Legal Regulatory Authorities, Legislature and Parliament, other Legal Functionaries, Market Institutions, Law Firms, Companies and Local Self Government. As part of the internship programme the College may, at the expense of the students, arrange
for visits to the Supreme Court of India, Parliament House, Human Rights

Commission, and Election Commission.

iii. The course teacher shall utilize at least 20% of the teaching hours for conducting seminars, debates, assignments & tests.

6. Moot court exercise and Internship:

(a) Moot Court: Every student is required to do at least three moot courts in a year. The moot court work will be on assigned problem and it will be evaluated for written submissions and for oral advocacy and as per the prescribed marks / credits by the University**.**

(b) **Observance of Trial in two cases, one Civil and one Criminal**:

Students are required to attend two trials in the course of the last two or three years of B.A.LL.B / B.B.A.LL.B studies. They will maintain a record and enter the various steps observed during their attendance on different days in the court assignment. This scheme will carry marks / credits prescribed by the University.

(c) **Interviewing techniques and Pre-trial preparations and Internship diary**:

Each student will observe two interviewing sessions of clients at the Lawyer's Office/Legal Aid Office and record the proceedings in a diary, which will carry prescribed marks / credits. Each student will further observe the preparation of documents and court papers by the Advocate and the procedure for the filing of the suit/petition. This will be recorded in the diary, which will carry prescribed marks / credits.

(d) The fourth component of this paper will be **Viva Voce examination** on all the above three aspects carrying prescribed marks.

6.1. Internship - Minimum Period:

i. Each registered student shall have completed minimum of 12 weeks internship for Three Year Course stream and 20 weeks in case of Five Year Course stream during the entire period of legal studies under NGO, Trial and Appellate Advocates, Judiciary, Legal Regulatory authorities, Legislatures and Parliament, Other Legal Functionaries, Market Institutions, Law Firms, Companies, Local Self Government and other such bodies as the University shall stipulate, where law is practiced either in action or in dispute resolution or in management.

ii. Provided that internship in any year cannot be for a continuous period of more than Four Weeks and all students shall at least gone through once in the entire academic period with Trial and Appellate Advocates.

iii. Each student shall keep Internship diary in such form as may be stipulated by the University concerned and the same shall be evaluated by the Guide in Internship and also a Core Faculty member of the staff each time. The total mark shall be assessed in the Final Semester of the course in the 4th Clinical course as stipulated under the Rules in Schedule II.

6.2. Formal Dress Code during Internship:

Students placed under internship or in moot court exercise shall have formal dress of legal professional in pupilage as follows:

a. (For all) White/Black trouser, white shirt, black tie, black coat, black shoe and black socks. When students have problems of getting the entire formal dress for any reason, they have to have a white trouser, full sleeve shirt to be tucked in and covered shoe.
b. (Optional for Girl students) Black printed saree, with white full sleeve blouse and covered black shoe or Lawyer's Suit with black covered shoe.
c. The Organization or Advocate under whom the internee is placed is required to follow suitable dress code.

7. Credit Distribution

7.1. A candidate has to earn 240 credits for successful completion of FIVE year Law degree with the distribution of credits for different courses prescribed by the Board of Studies in Legal Studies.

7.2. Every course including project work, practical work, field work, self-study elective should be entitled as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE)** as defined by the BOS concerned.

7.3. A candidate can enroll for a maximum of 32 credits and a minimum of 20 credits per Semester. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

7.4. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to X semester and complete successfully 240 credits in 10 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards /

advantages which could be applicable for all full time students and for hostel facilities.

8. Add-on Proficiency Certification and Diploma:

8.1. Add-on Proficiency Certification

To acquire **Add on Proficiency Certification** a candidate can opt to complete a minimum of 4 extra credits either in the same discipline / subject or in different discipline / subject in excess to 240 credits for the Bachelor's Degree in Law.

8.2. Add on Proficiency Diploma:

To acquire **Add on Proficiency Diploma,** a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 240 credits for the Bachelor's Degree in Law.

8.3. The A**dd on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

9. Scheme of Assessment & Evaluation for Five Year Degree Program

9.1. The Scheme of Assessment and Evaluation will have two parts, namely;

ii. Internal Assessment (IA); and
iii. Semester End Examination (SEE)

9.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG non engineering programs and PG programs shall carry 50 marks each (i.e., 50 marks internal assessment; 50 marks semester end examination).

9. 3. The 50 marks of Internal Assessment (IA) shall comprise of:

Internal Test	= 30 marks
Assignments	= 10 marks
Seminars	= 10 marks

9.4. There shall be **three internal tests** conducted as per the schedule given below. T**he students have to attend all the three tests compulsorily.**

- 1st test for 15 marks at the end of 5th week of the beginning of the Semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the Semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the Semester.

9.5. The coverage of syllabus for the said three tests shall be as under:

- For the 1st test syllabus shall be 1st unit and 1st half of Second Unit of the Course;
- For the 2nd test it shall be 2nd half of Second Unit and Third Unit of the Course;
- For the 3rd test the syllabus will be 4th Unit of the Course.

9.6. **Out of 3 tests, the highest marks scored in two tests are automatically considered while assessing the performance of the students**.

9.7. There shall be two Assignments and two Seminars each carrying 5 marks. Hence two assignments carry 10 marks (5+5 marks) and two seminars carry 10 marks (5+5 marks) as stated at Sl.No. 3 above.

9.8. The Semester End Examination for 50 marks shall be held during 19th and 20th week of the beginning of the semester and **the syllabus for the semester end examination shall be entire 4 units**.

9.9. The **duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours.**

10. Evaluation of Clinical practice / Moot Court/ Internship

10.1. A Moot Court mock shall be assessed on the basis of:

a) Doctrinal Knowledge of relevant subject;

b) Advocacy Skills involved;

c) Decorum / Methodology.

10.2. In case of Moot Court / Clinical Practice / Internship course(s), the performance of a candidate shall be assessed for a maximum of 100 marks as explained below:

(a) Continuous assessment (IA) = 50 marks

(b) Semester end practical examination = 50 marks

10.3. The Moot Court / Clinical Practice shall be conducted throughout the Semester. The 50 marks meant for continuous assessment shall further be allocated as under:

i	Regular Participation in Moot Court / Clinical Practice throughout the semester	05 marks
ii	Written Submission/ Memorials	20 marks
iii	Oral Advocacy	20 Marks
Iv	Dress / Court Decorum	05 marks
	Total	**50 marks**

10.4. The 50 marks meant for Semester End Examination for Moot Court / Clinical Practices, shall be allocated as under:

i	Written Submission (Content + Structure)	20 marks
ii	Oral Advocacy Skills (Presentation + Decorum)	20 marks
iii	Dress Code	05 marks
iv	Response to Queries (Questions and Answers)	05 marks
	Total	**50 marks**

10.5 The Semester End Examination for Moot Court / Clinical Practices will be conducted jointly by internal and external examiners. However, if external examiner does not turn up, then both the examiners will be internal examiners.

10.6. In case a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for Semester End component will be as decided by the BoS concerned.

10.7. The duration for semester-end practical examination shall be decided by the concerned School

Board.

11. Evaluation of Internship:

Right from the initial stage of Internship, the candidate has to maintain the Dairy record the activities daily, obtain countersignature from the supervisor. After completion of the internship the candidate has to prepare a draft report of the internship work done based on the records in his/her dairy under the guidance of the supervisor and submit the final report of the internship for final evaluation. The components of evaluation are as follows:

Component – I	IA	Daily Diary / Periodic Progress (25%)
Component – II	IA	Draft Report of Internship (25%)
Component– III	SEE	Final Evaluation of Internship report and Viva-Voce (50%). Evaluation of the report is for 30% and the viva-Voce examination is for 20%.

11.1. Evaluation of Minor Project / Major Project / Dissertation / Internship:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	IA	Daily Diary / Periodic Progress (25%)
Component – II	IA	Draft Report (25%)
Component– III	SEE	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

11.2. The details of continuous assessment are summarized in the following table:

Summary of Continuous Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
Allocation of Topics for Assignments / Seminars	Beginning of 5th Week	First Unit and Second Unit		Instructional process and Continuous Assessment
First Internal Test	Second Part of 6th	First Unit and 1st half of	15	Consolidation of First Unit and 1st half of

	Week	Second Unit		Second Unit
Submission of Assignments	8th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Seminars	9th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Second Internal Test	2nd Part of 13th Week	2nd half of Second Unit and Third Unit	15	Consolidation of 2nd half of Second Unit and Third Unit
Allocation of Topic for 2nd Assignment / Seminars	11th Week	Third Unit and Fourth Unit		Instructional process and Continuous Assessment
Submission of Assignments	13th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Seminars	14th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Third Internal Test	2nd Part of 16th Week	Fourth Unit	15	Consolidation of entire Fourth Unit
Semester End Practical Examination	17th & 18th Week	Entire syllabus	50	Conduct of Semester - end Practical Exams
Preparation for Semester–End Exam	17th & 18th Week	Entire Syllabus		Revision and preparation for semester–end exam
Semester End Theory Examination	19th and 20th Week	Entire Syllabus	50	Evaluation and Tabulation
	End of 21st Week			Notification of Final Grades

Note: 1. *Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 days after completion of the examination.*

1. *Practical examination wherever applicable shall be conducted after 3rd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Registrar (Evaluation) who will notify the same immediately*

12. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components, he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the candidate if his/her submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance Cell is final.

For every program there will be one Grievance Cell. The composition of the Grievance Cell is as follows:

- The Registrar (Evaluation) - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

13. Eligibility to Appear SEE (Semester - end) Examination

Only those students who fulfill a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the course(s), as provided in the succeeding sections, shall be eligible to appear for IA3 examination.

14. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

14.1. Requirements to Pass a Course

A candidate's performance from IA & SEE components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (IA=50; + SEE=50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 30% (15 marks) in SEE which is compulsory.

14.2 Provision to Carry Forward the Failed Subjects / Courses:

A student who has passed in at least one course in each of odd and even semesters but failed in remaining courses shall move to next semesters of succeeding years up to 6^{th} semester of the study. But, to move to VII semester of study, the student should have passed in all courses of I and II semesters. However, he / she may carry forward a maximum of 6 courses from III

to VI semesters together. Such a student who carries forward the previous year's courses shall appear for Semester end examinations of failed courses of previous semesters concurrently with odd semester end examination and / or even semester end examinations of current year of study. Further, he / she shall have to clear all courses of both odd and even semesters of III and IV semesters to register for IX semester. However, he / she shall have to clear all courses of all semesters within the double duration, i. e., within ten years of admission of the first semester failing which the student has to re-register to the entire program.

Examples:-

a. Student "A" has passed in one Course in First Semester and one course in II Semester and has failed in all other Courses of I Semester and II Semester. He / she is eligible to seek admission for III Semester and appear for Semester End examination of all failed Courses of I Semester concurrently with III Semester End examination. Likewise, he / she is eligible to move to IV semester and appear for Semester End examination of all the failed Courses of II Semester concurrently with IV Semester End examination.

b. Student "B" studying in 2nd year of law program and has passed in one course in III Semester and one course in IV Semester and has failed in all other Courses of III Semester and IV Semesters. He / she is eligible to seek admission for V Semester and further move to VI semester. He / she may appear for Semester End examination of all failed Courses of I and III semesters concurrently with V Semester End examination and all failed Courses of II and IV Semesters concurrently with VI Semester End examination.

c. Student "C" who has completed 3 years of studies in law program and has passed in all the courses I and II Semester and has passed in 1 Course in each of III, IV, V and VI Semesters. He / she is eligible to seek admission for VII Semester and appear for Semester end examination of all failed Courses of III and V Semesters concurrently with VII Semester End examination. Likewise, he / she is also eligible to move to VIII semester and appear for Semester End examination of all failed Courses of IV and VI Semesters concurrently with VIII Semester End examination.

d. Student "D" has completed 3 years of studies in law program and has passed in all courses of I Semester but has failed in few courses in II semester. He / she has passed in few courses of III semester and few courses in IV semester and has also has passed in 1 Course in each of the V and VI Semesters. The student 'D' is not eligible to move to VII semester unless he / she reappears and pass in all courses of II semester, and hence, he / she is detained. However, he / she may appear for Semester End examination of all failed Courses of III and V semester examination concurrently in the coming years' odd Semester End examination and also appear

for all failed courses of II, IV and IV Semesters concurrently in the coming years of even Semester End examination.

e. Student "E" who has completed 4 years of studies in law program and has passed in all the courses of I,II,III and IV Semesters. He / she has also passed in 1 Course in each of V, VI, VII and VIII Semesters. The student "E" is eligible to seek admission for IX Semester and move forward to X semester. He / She may appear for Semester End examination of all failed Courses of V and VII Semesters concurrently with IX Semester End examination and all failed Courses of VI and VIII Semesters concurrently with X Semester End examination. However, he / she has to pass all the failed courses of V, VI, VII and VIII along with IX and X Semester courses to earn Law Degree (BA LLB / BBA LLB).

f. Student "F" has completed 4 years of studies in law program and has passed in all courses of I, II, IV and V Semesters but has failed in few courses in III semester, few courses in VI semester. He / she has also has passed in 1 Course in each of the VII and VIII Semesters. The student 'F' is not eligible to move to IX semester because he / she has not passed in III semester and hence he / she is detained. Therefore, student "F" has to appear for Semester End examination of all failed Courses of III semester and pass to become eligible to move to IX semester. However, the student "F" may appear for Semester End examination of all the failed courses of VII semesters in the coming years' odd semester End examination and also appear for all failed courses of VI and VIII Semesters concurrently in the coming years of even semesters' Semester End examination.

15. Re-Registration and Re-Admission:

a) In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

b) In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

16. Attendance Requirement:

(a) All students must attend every lecture, tutorial and practical classes.

(b) Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc., during a semester shall not be permitted to appear to the semester end examination and such student shall seek re-admission as provided above.

(c) A candidate who has officially represented the University / College / State / Nation in Sports,

NCC, NSS, Cultural Programme, Moot Court Competition, Legal Aid, Lok Adalat or involved in preparation of Public Interest Litigation, shall be exempted from attendance requirement to the extent of the days of such participation, which shall not exceed 15 days per semester.

(d) Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of Semester End examination, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of Semester End examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

16.1 Absence during Internal Assessment Tests:

In case a student has been absent from a Internal Tests due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Head of the School, for make-up examination. The Head of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a separate Internal Test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances Internal Test(s) shall be held and Assignment(s) are considered after Semester End Examination.

17. Grade Card and Grade Point:

a. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. The Provisional Grade Card provides **Semester Grade Point Average** (SGPA).

b. **Final Grade Card:** Upon successful completion of B.A.L.L.B./B.B.AL.L.B. Degree, a Final Grade Card consisting of GRADES of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

c. **The Grade and the Grade Point:** The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks P	Grade G	Grade Point (GP=V x G)	Letter Grade
90 >100	10	v*10	O
80 > 90	9	v*9	A+
70 > 80	8	v*8	A

60 > 70	7	v*7	B+
55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C+
40 > 50	5	v*5	C
0-40	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B – Above Average, C+ - Average; C-Satisfactory; F – Unsuccessful (Fail)

Here, P is the percentage of marks (P= [(IA)+M] secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

18. Computation of SGPA and CGPA

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester

a. Computation of SGPA :

Following is the procedure to compute the Semester Grade Point Average (SGPA):

SGPA (Si) = ∑(Ci x Gi) / ∑Ci where Ci is the number of credits of the course and Gi is the Grade Point scored by the student in the course.

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	**4**	**A+**	**9**	**4X9=36**
Course 2	**4**	**A**	**8**	**4X8=32**
Course 3	**3**	**B+**	**7**	**3X7=21**
Course 4	**3**	**O**	**10**	**3X10=30**
Course 5	**3**	**P**	**5**	**3X5=15**
Course 6	**3**	**B**	**6**	**3X6=18**
Course 7	**2**	**O**	**10**	**2X10=20**
Course 8	**2**	**A**	**8**	**2X8=16**
	24			**188**

Thus, **SGPA = 188 ÷ 24 = 7.83**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	**4**	**A**	**8**	**4X8=32**

Course 2	**4**	**B+**	**7**	**4X7=28**
Course 3	**3**	**A+**	**9**	**3X9=27**
Course 4	**3**	**B+**	**7**	**3X7=21**
Course 5	**3**	**B**	**6**	**3X6=18**
Course 6	**3**	**P**	**5**	**3X5=15**
Course 7	**2**	**B+**	**7**	**2X7=21**
Course 8	**2**	**O**	**10**	**2X10=20**
	24			**175**

Thus, **SGPA = 175 ÷ 24 = 7.29**

Illustration No.3

Course	**Credit**	**Grade Letter**	**Grade Point**	**Credit Point (Credit x Grade point)**
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			199

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (240) for B.A.L.L.B./B.B.AL.L.B. Degree is calculated taking into account all the courses undergone by a student over all the semesters of a program, i.e. : **CGPA = ∑(Ci x Si) / ∑Ci**

Where Si is the SGPA of the semester and Ci is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration:

CGPA after Final Semester

Semester (ith)	**No. of Credits (Ci)**	**SGPA (Si)**	**Credits x SGPA (Ci X Si)**
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	24	7.40	24 x 7.40 = 177.6
5	24	8.29	24 x 8.29 = 198.96
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222.00
9	24	9.35	24x9.35 = 224.40

10	24	9.50	24x9.50 = 228.00
Cumulative	240		2007.28

Thus, **CGPA** = $\frac{24x6.83+24x7.29+24x8.11+24x7.40+24x8.29+24x8.58+24x9.12+24x9.25\ 24x9.35\ 24x9.50}{240} = 8.36$

c. CONVERSION OF GRADES INTO PERCENTAGE:

Conversion formula for the conversion of CGPA into Percentage is:
Percentage of marks scored = CGPA Earned x 10
Illustration: CGPA Earned 8.36 x 10 = 83.6

19. Classification of Results

The Final Grade Point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows:

CGPA	**Grade (Numerical Index)**	**Letter Grade**	**Performance**	**FGP**
	G			**Qualitative Index**
9 >= CGPA 10	10	O	Outstanding	First Class with Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4.5 CGPA <5	5	C	Pass	Satisfactory
<4 CGPA	0	F	Unsatisfactory	Unsuccessful

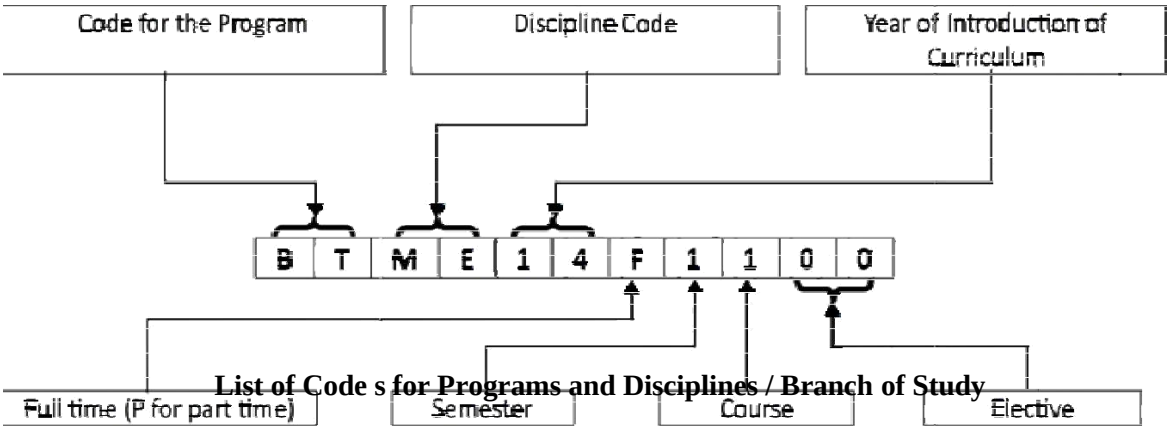
Overall percentage=10*CGPA

20. Challenge Valuation

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 10 days after the announcement of the results. This challenge valuation is only for marks secured in Semester End Examination.

21. The answer scripts for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

Course Numbering Scheme



List of Code s for Programs and Disciplines / Branch of Study

Program Code	Title of the Program	Discipline Code	Name of the Discipline / Branch of Study
BA	Bachelor of Arts	AE	Advanced Embedded Systems
BB	BBM (Bachelor of Business	AI	Advanced Information Technology
BC	B.Com (Bachelor of	AP	Advanced Power Electronics
BR	B. Arch (Bachelor of Architecture)	CA	Computer Aided Structural Engineering
BS	B.Sc., BS (Bachelor of Science)	CE	Civil Engineering
BT	B.Tech (Bachelor of Technology)	CH	Chemistry
BP	Bachelor of Computer Applications	CO	Commerce
BL	LL.B (Bachelor of Law)	CS	Computer Science and Engineering / Computer Science
MA	Master of Arts	DE	Data Engineering and Cloud Computing
MB	MBA (Master of Business Administration)	EC	Electronics and Communication Engineering
MC	M.Com (Master of Commerce)	EN	English
MS	M.Sc. / MS (Master of Science)	MD	Machine Design an d Dynamics

MT	M Tech (Master of Technology)	ME	Mechanical Engineering
MC	Master of Computer Applications	EE	Electrical & Electronics Engineering

B.B.A., LL.B (Honors) Program

Program Overview

The School of Legal Studies offers BBA LL.B (Hons) Law Program which is a five year integrated graduate academic degree which integrates the Management stream with that of Law, which is designed as per the BCI norms to equip students with a sound understanding of the foundations of legal knowledge and develop students' analytical and research skills, generic skills which they need in their future careers in Legal Profession. The program offers students the opportunity to study law from an extensive catalogue of related subjects and optional subjects, covering vast range of legal knowledge. The students of law are encouraged to learn on the complexity of legal practice and of the variety of ways of understanding role of law in contemporary society. The students are also provided with internship under NGOs, Trial and Appellate Advocates, Judiciary, Legal Regulatory Authorities, other Legal Functionaries, Law Firms, Companies, and Local Self Government. They are also facilitated with practical training through participation in Moot Court exercises, Legal Aid Clinic, and Lok Adalat. The completion of the program ensures that they will be able to walk into any courtroom and feel right at home.

The eligibility requirement for Law degree was that the applicant should already have a Bachelor's degree in any subject from a recognized institution (3 year LL.B). But now, universities offer 5 year integrated degree with the title of B.A., LL.B. (Honors), B.B.A, LL.B. (Honors) etc. as per the norms of BCI. India, today produces the largest number of legal professionals in the world. According to reports, about half a million law students pass out from various colleges in India. The Indian legal market is in a nascent stage in terms of growth. A law student with all desired skills, inherent interests has a wide range legal professional opportunities available these days. One way, lawyers are required in all walks of life.

The law graduates have ample career opportunities to serve/practice in Courts and Tribunals ranging from District Court to the High Court in different capacities. They also have an opportunity to prosper as successful lawyers at district, state and national levels. Legal professionals also have opportunities of being appointed by business firms, industrial sectors, insurance companies and several such sectors as legal knowledge in various sectors has become an essence.

In this context, an integrated Program in legal studies leading to B.B.A., LL.B., (Honors) degree of REVA UNIVERSITY is designed to create legal professionals to meet the human resources requirements of various sectors of Society.

The program offers students an opportunity to study law by choosing courses from a repository of related courses.

Program Educational Objectives (PEOs)

The aim of the program is to produce legal Professionals with advanced legal knowledge and to bring the critical, analytical, problem solving legal skills and Critical thinking and logical reasoning skills to meet higher level expectations of legal system, academics, and research establishments.

The Program Educational Objectives are to prepare the students to:

1. Be advocate to practice in different Courts and Tribunals in India.
2. Be part of Indian judicial system like magistrate, civil judge, presiding officers in different judicial forums.
3. To act as Legal Services Director in public, private and government organizations.
4. Pursue higher degrees to work in Colleges, Universities as professors.
5. Be independent tax consultant.
6. To be arbitrator and mediator ion the process of outside court settlement.
7. Can start his own Law Firm.
8. Work as member of Law Firm and can also head a wing of the law firm.
9. Adopt lifelong learning philosophy for continuous improvement.
10. To be a socially responsible citizen
11. Develop the knowledge to create legal awareness in society for attaining social and economic justice

PROGRAM OUTCOMES: -

After undergoing this program, a student will be able to: -

1. Explain and analyse the substantive and procedural laws.
2. Analyse legal document and resolve problems legally to achieve social and economic justice.
3. Understand the principles of law, its processes, procedures and relevant application in the legal world.
4. Demonstrate and provide adequate legal skills in different areas of legal profession.
5. Conduct legal research using analytical and critical thinking.
6. Develop a global perspective towards various legal issues.
7. Practice advocacy skills in different legal profession.
8. Develop the skill in Drafting of legal documents and Law reports.
9. Work as individual and team member in resolving issues in Legal Profession
10. Update the legal knowledge with the latest amendments.

PROGRAM SPECIFIC OUTCOMES:

1. Understand the structure, components and functioning of the various institutions of the Indian legal system and the role of law in day to day life.
2. Describe the general principles of law with the nature and sources of law, relation of law with human and institutional agencies responsible for the protection of human rights, liberty and balancing the interests of the individuals and society. .
3. Demonstrate the concepts of the legal provisions by addressing the ideological framework and analyse and apply for the benefit of the larger society

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PSO1	PSO2	PSO3
BBBL16F1100	CO1	3	3	2	3	3	2	2	3	2	3			
	CO2	3	3	3	2	2	2	3	3	2	3			
	CO3	3	3	2	2	2	2	1	2	3	2			
	CO4	3	3	2	3	3	2	2	3	3	2			
BBBL16F1200	CO1	1	2	3	1	2	2	1	1	2	2			
	CO2	1	2	3	1	1	2	3	2	2	1			
	CO3	2	2	2	3	2	2	1	2	1	2			
	CO4	2	3	2	3	3	2	2	1	3	3			
BBBL16F1300	CO1	2	2	3	2	1	2	3	2	3	2	3	3	3
	CO2	3	3	3	3	3	2	3	2	3	2	3	3	3
	CO3	3	2	3	2	2	3	2	2	2	2	3	3	3
	CO4	2	3	3	3	3	2	3	3	2	2	3	3	3
BBBL16F1400	CO1	1	1	1	1	2	3	1	1	1	1			
	CO2	1	1	3	1	1	2	1	1	2	1			
	CO3	2	2	1	1	1	2	1	1	2	2			
	CO4	2	1	2	2	2	2	1	2	2	2			
BBBL16F1500	CO1	2	3	2	1	2	3	1	1	2	2			
	CO2	1	2	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	3	2			
	CO4	3	3	1	3	3	2	1	3	2	1			
BBBL16F1600	CO1	2	2	3	3	3	3	3	2	3	3			
	CO2	3	3	3	3	2	3	2	3	2	2			
	CO3	3	2	3	2	3	2	2	2	2	3			
	CO4	3	3	2	3	2	3	3	2	2	2			
BBBL16F1700	CO1	3	3	2	3	3	2	2	3	2	3			
	CO2	3	3	3	2	2	2	3	3	2	3			
	CO3	3	3	2	2	2	2	1	2	3	2			
	CO4	3	3	2	3	3	2	2	3	3	2			
BBBL16F2100	CO1	1	2	3	1	2	2	1	1	2	2			
	CO2	1	2	3	1	1	2	3	2	2	1			
	CO3	2	2	2	3	2	2	1	2	1	2			
	CO4	2	3	2	3	3	2	2	1	3	3			
BBBL16F2200	CO1	2	2	2	1	2	3	1	3	2	1			
	CO2	1	1	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	2	2			
	CO4	3	2	1	2	3	2	2	3	2	3			
BBBL16F2300	CO1	2	3	2	1	2	3	1	1	2	2			
	CO2	1	2	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	3	2			
	CO4	3	3	1	3	3	2	1	3	2	1			
BBBL15F2400	CO1	3	3	2	3	3	3	2	2	2	2			
	CO2	3	2	3	3	3	3	3	3	3	2			
	CO3	3	3	3	2	2	3	3	3	3	3			
	CO4	2	3	3	3	3	2	3	3	3	3			
BBBL16F2500	CO1	2	2	3	2	1	2	3	2	3	2			

	CO2	3	3	3	3	3	2	3	2	3	2			
	CO3	3	2	3	2	2	3	2	2	2	2			
	CO4	2	3	3	3	3	2	3	3	2	2			
BBBL16F2600	CO1	1	1	1	1	2	3	1	1	1	1			
	CO2	1	1	3	1	1	2	1	1	2	1			
	CO3	2	2	1	1	1	2	1	1	2	2			
	CO4	2	1	2	2	2	2	1	2	2	2			
BBBL16F2700	CO1	2	2	3	1	2	2	2	2	2	1	3	3	3
	CO2	3	2	3	1	2	2	2	2	2	2	3	3	3
	CO3	2	1	3	1	2	2	1	1	3	2	3	3	3
	CO4	3	1	2	2	3	2	1	1	2	3	3	3	3
BBBL16F2800	CO1	3	3	3	3	3	2	3	2	3	3	3	3	3
	CO2	3	3	3	3	2	2	3	3	3	3	3	3	3
	CO3	3	2	3	3	3	2	3	2	2	3	3	3	3
	CO4	3	3	3	3	3	2	3	3	2	2	3	3	3
BBBL16F3100	CO1	2	3	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	3	3	1	3	2	1	1	3	3	3	2	3
	CO3	2	1	2	2	2	3	2	2	2	2	2	3	3
	CO4	2	3	1	1	3	3	1	2	2	2	3	3	3
BBBL16F3200	CO1	3	3	2	3	3	2	2	3	2	3	2	3	3
	CO2	3	3	3	2	2	2	3	3	2	3	2	3	3
	CO3	3	3	2	2	2	2	1	2	3	2	2	2	3
	CO4	3	3	2	3	3	2	2	3	3	2	2	3	2
BBBL16F3300	CO1	2	3	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	3	3	1	3	2	1	1	3	3	3	2	3
	CO3	2	1	2	2	2	3	2	2	2	2	2	3	3
	CO4	2	3	1	1	3	3	1	2	2	2	3	3	3
BBBL16F3400	CO1	3	3	2	3	3	2	2	3	2	3	2	3	3
	CO2	3	3	3	2	2	2	3	3	2	3	2	3	3
	CO3	3	3	2	2	2	2	1	2	3	2	2	2	3
	CO4	3	3	2	3	3	2	2	3	3	2	2	3	2
BBBL16F3500	CO1	1	2	2	1	2	3	1	1	2	2			
	CO2	1	1	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	2	2			
	CO4	3	3	1	3	3	2	2	3	2	1			
BBBL16F3600	CO1	2	3	2	2	2	2	1	2	2	1			
	CO2	3	3	3	1	3	2	1	1	3	3			
	CO3	2	1	2	2	2	3	2	2	2	2			
	CO4	2	3	1	1	3	3	1	2	2	2			
BBBL16F3700	CO1	2	2	3	3	3	2	3	3	2	3	3	3	3
	CO2	3	3	3	2	3	2	2	2	2	1	3	3	3
	CO3	2	2	3	2	3	3	2	2	2	2	3	3	3
	CO4	3	2	3	2	2	2	1	2	3	3	3	3	3
BBBL16F3800	CO1	2	3	1	2	1	1	2	1	2	1	3	3	3
	CO2	1	2	3	2	2	2	2	2	2	3	3	3	3
	CO3	3	2	3	1	1	1	1	2	3	1	3	3	3
	CO4	2	3	2	2	2	1	3	2	2	3	3	3	3
BBBL16F4100	CO1	2	3	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	3	3	1	3	2	1	1	3	3	3	2	3

	CO3	2	1	2	2	2	3	2	2	2	2	2	3	3
	CO4	2	3	1	1	3	3	1	2	2	2	3	3	3
BBBL16F4200	CO1	3	2	3	2	2	3	2	3	3	3	3	3	3
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	CO3	3	2	2	2	2	2	3	2	2	3	3	3	2
	CO4	3	2	3	2	2	2	2	3	2	3	2	3	3
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	CO4	1	1	2	2	1	2	3	2	1	1			
BBBL16F4400	CO1	2	1	2	2	1	2	2	1	1	2	3		
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	CO3	2	1	2	2	2	2	1	1	2	2	3		
	CO4	2	2	1	2	1	2	1	2	1	2	3		
BBBL16F4500	CO1	3	2	2	3	2	2	3	3	2	3	3	3	3
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	CO3	2	2	3	2	2	2	2	2	2	3	3	3	3
	CO4	2	3	2	3	3	2	2	3	3	2	3	3	3
BBBL16F4600	CO1	2	1	2	1	3	1	1	2	1	2	3	3	3
	CO2	3	2	3	2	3	1	2	2	2	3	3	3	3
	CO3	3	2	3	1	3	2	2	1	1	3	3	3	3
	CO4	1	1	2	2	1	2	3	2	1	1	3	3	3
BBBL16F4700	CO1	3	2	3	2	3	2	2	1	2	1	3	3	3
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BBBL16F5100	CO1	3	2	2	3	2	2	3	3	2	3	3	3	3
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	CO3	2	2	3	2	2	2	2	2	2	3	3	3	3
	CO4	2	3	2	3	3	2	2	3	3	2	3	3	3
BBBL16F5200	CO1	2	1	2	1	3	1	1	2	1	2	3	3	3
	CO2	3	2	3	2	3	1	2	2	2	3	3	3	3
	CO3	3	2	3	1	3	2	2	1	1	3	3	3	3
	CO4	1	1	2	2	1	2	3	2	1	1	3	3	3
BBBL16F5300	CO1	3	2	3	2	3	2	2	1	2	1	3	3	3
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	CO3	2	2	3	2	3	3	2	2	2	2	3	3	3
	CO4	3	2	3	2	2	2	1	2	3	3	3	3	3
BBBL16F5400	CO1	2	1	2	2	1	2	2	1	1	2	3	3	3
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	CO3	2	1	2	2	2	2	1	1	2	2	3	3	3
	CO4	2	2	1	2	1	2	1	2	1	2	3	3	3
BBBL16F5500	CO1	1	1	1	1	2	3	1	1	1	1	3	3	3
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	CO3	2	2	1	1	1	2	1	1	2	2	3	3	2
	CO4	2	1	2	2	2	2	1	2	2	2	3	2	3
BBBL16F5610	CO1	2	3	3	2	2	2	2	3	2	2	3	3	3
	CO2	3	3	3	3	3	2	2	2	3	2	3	3	2
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	CO4	3	3	3	3	3	2	3	3	2	2	3	3	3
BBBL16F6100	CO1	1	2	1	2	2	1	2	1	3	1	2	3	3
	CO2	2	3	2	3	2	3	2	2	3	3	3	3	3
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BBBL16F6200	CO1	3	1	3	2	2	1	3	2	2	2	3	3	3
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	CO3	3	2	3	1	2	2	1	1	1	2	3	3	3
	CO4	3	2	3	3	2	1	2	2	1	3	3	3	3
BBBL16F6300	CO1	2	3	3	1	3	3	1	2	2	2			
	CO2	2	3	2	2	3	3	1	2	3	2			
	CO3	2	3	3	1	3	2	2	2	3	3			
	CO4	1	3	1	1	3	2	1	1	3	2			
BBBL16F6400	CO1	2	1	2	1	3	1	1	2	1	2	3	3	3
	CO2	3	2	3	2	3	1	2	2	2	3	3	3	3
	CO3	3	2	3	1	3	2	2	1	1	3	3	3	3
	CO4	1	1	2	2	1	2	3	2	1	1	3	3	3
BBBL16F6500	CO1	2	2	2	2	2	2	2	4	3	2	2	2	3
	CO2	2	3	2	3	2	2	2	2	3	2	3	3	2
	CO3	3	2	1	2	2	2	3	2	2	3	3	3	2
	CO4	3	2	3	2	2	2	2	3	1	2	3	2	3
BBBL16F6610	CO1	1	1	2	1	2	1	2	2	1	3	3	3	2
	CO2	3	1	2	2	1	2	2	2	2	2	3	3	2
	CO3	2	2	2	1	3	3	2	2	2	3	3	3	3
	CO4	2	3	2	1	3	2	1	2	2	2	3	3	3
BBBL16F6620	CO1	3	2	2	1	2	2	1	1	2	3	3	3	3
	CO2	1	2	3	1	1	2	3	1	2	1	3	3	3
	CO3	2	2	2	1	2	2	1	2	1	2	3	3	3
	CO4	2	3	2	3	3	2	2	3	3	2	3	3	3
BBBL16F7100	CO1	2	1	1	1	1	1	1	1	1	1	3	3	3
	CO2	1	1	3	1	1	1	1	1	1	1	3	3	2
	CO3	1	1	2	1	1	1	1	1	1	1	2	3	3
	CO4	1	1	2	1	1	1	1	1	1	1	2	3	3
BBBL16F7200	CO1	2	1	2	1	3	1	1	2	1	2			
	CO2	3	2	3	2	3	1	2	2	2	3			
	CO3	3	2	3	1	3	2	2	1	1	3			
	CO4	2	2	1	2	2	1	2	1	3	3			
BBBL16F7300	CO1	2	3	2	3	2	1	1	2	3	2			
	CO2	3	2	1	2	2	2	3	2	1	3			
	CO3	3	2	3	3	1	2	2	3	1	1			
	CO4	1	1	1	2	1	1	1	1	2	2	3	3	3
BBBL16F7400	CO1	2	1	1	1	3	3	1	3	2	2	3	3	3
	CO2	2	3	2	1	1	1	1	3	3	2	3	3	3
	CO3	2	2	3	2	2	3	3	3	2	1	3	3	3
	CO4	2	2	2	1	2	3	1	3	2	1			

BBBL16F7500	CO1	1	1	3	1	1	2	3	1	2	1			
	CO2	2	2	2	1	2	3	1	2	2	2			
	CO3	3	2	1	2	3	2	2	3	2	3			
	CO4	1	2	2	1	2	3	1	1	2	2			
BBBL16F7600	CO1	1	1	3	1	1	2	3	1	2	1	3	3	3
	CO2	2	2	2	1	2	3	1	2	2	2	3	3	3
	CO3	3	3	1	3	3	2	2	3	2	1	3	3	3
	CO4	1	1	2	1	2	2	1	1	2	2	3	3	2
BBBL16F7700	CO1	3	2	2	1	2	2	1	1	1	3	3	3	3
	CO2	2	2	2	1	1	1	1	2	3	2	2	3	3
	CO3	2	2	2	1	2	3	1	2	2	3	3	3	3
	CO4													
BBBL16F8200	CO1	1	2	1	2	2	1	2	1	3	1	2	3	3
	CO2	2	3	2	3	2	3	2	2	3	3	3	3	3
	CO3	3	2	2	2	3	2	3	2	1	3	3	3	3
	CO4	3	2	3	3	1	2	2	3	1	3	3	2	3
BBBL16F8300	CO1	1	2	2	1	2	3	1	1	2	2			
	CO2	1	1	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	2	2			
	CO4	3	3	1	3	3	2	2	3	2	1			
BBBL16F8400	CO1	2	1	2	1	2	1	1	1	1	2	3	3	3
	CO2	2	2	2	2	1	1	1	2	1	2	2	3	3
	CO3	3	2	2	3	1	1	1	1	1	3	3	2	3
	CO4	2	2	2	2	1	2	1	1	1	2	2	3	3
BBBL16F8500	CO1	3	3	3	3	3	2	3	2	3	3			
	CO2	3	3	3	3	2	2	3	3	3	3			
	CO3	3	2	3	3	3	2	3	2	2	3			
	CO4	3	3	3	3	3	2	3	3	2	2			
BBBL16F8610	CO1	2	3	2	2	2	2	1	2	2	1			
	CO2	3	3	3	1	3	2	1	1	3	3			
	CO3	2	1	2	2	2	3	2	2	2	2			
	CO4	2	3	1	1	3	3	1	2	2	2			
BBBL16F8620	CO1	1	2	1	2	2	1	2	1	3	1	2	3	3
	CO2	2	3	2	3	2	2	1	2	3	2	3	3	2
	CO3	3	2	1	2	2	2	3	2	1	3	3	2	3
	CO4	3	2	3	2	1	2	2	3	1	1	3	3	3
BBBL16F8630	CO1	1	3	1	2	1	1	2	1	2	1	3	3	3
	CO2	2	1	1	1	1	3	2	3	1	3	3	3	3
	CO3	3	2	2	2	2	1	3	3	1	2	3	3	3
	CO4	2	1	3	3	1	2	2	1	2	2	3	3	3
BBBL16F8640	CO1	2	1	2	2	2	2	1	2	1	2			
	CO2	1	1	2	1	1	2	1	2	1	2			
	CO3	2	2	1	2	2	2	1	2	2	2			
	CO4	2	2	3	2	3	2	1	2	2	2			
BBBL16F9100	CO1	2	2	3	3	3	2	3	3	2	2			
	CO2	2	2	2	3	3	2	3	3	2	2			
	CO3	2	2	1	2	3	2	3	3	2	2			
	CO4	2	3	2	2	3	2	2	2	3	2			
BBBL16F9200	CO1	2	1	2	1	2	1	1	1	1	2			

	CO2	2	2	2	2	1	1	1	2	1	2			
	CO3	3	2	2	3	1	1	1	1	1	3			
	CO4	2	2	2	2	1	2	1	1	1	2			
BBBL16F9300	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
BBBL16F9400	CO1	2	2	2	2	2	2	2	4	3	2			
	CO2	2	3	2	3	2	2	2	2	3	2			
	CO3	3	2	1	2	2	2	3	2	2	3			
	CO4	3	2	3	2	2	2	2	3	1	2			
BBBL16F9510	CO1	2	3	3	1	3	3	1	2	2	2			
	CO2	2	3	2	2	3	3	1	2	3	2			
	CO3	2	3	3	1	3	2	2	2	3	3			
	CO4	1	3	1	1	3	2	1	1	3	2			
BBBL16F9520	CO1	3	2	2	1	2	2	1	1	1	3	3	3	3
	CO2	2	2	2	1	1	1	1	2	3	2	2	3	3
	CO3	2	2	2	1	2	3	1	2	2	3	3	3	3
	CO4	3	2	2	1	2	2	1	1	1	3	3	3	3
BBBL16F9530	CO1	1	2	1	2	2	1	2	1	3	1	2	3	3
	CO2	2	3	2	3	2	3	2	2	3	3	3	3	3
	CO3	3	2	2	2	3	2	3	2	1	3	3	3	3
	CO4	3	2	3	3	1	2	2	3	1	3	3	2	3
BBBL16F9540	CO1	1	1	3	1	1	2	3	1	2	1	3	3	3
	CO2	2	2	2	1	2	3	1	2	2	2	3	3	3
	CO3	3	3	1	3	3	2	2	3	2	1	3	3	3
	CO4	1	1	2	1	2	2	1	1	2	2	3	3	2
BBBL16F9600	CO1	3	2	2	1	2	2	1	1	1	3	3	3	3
	CO2	2	2	2	1	1	1	1	2	3	2	2	3	3
	CO3	2	2	2	1	2	3	1	2	2	3	3	3	3
	CO4	3	2	2	1	2	2	1	1	1	3	3	3	3

BBA LLB PROGRAM
SCHEME OF INSTRUCTION

Course Code	Course Title	HC/SC/ FC/OE	Credits			
			L	T	P	Total
FIRST SEMESTER						
BBBL16F1100	Economic Development in India	HC	3	1	0	4
BBBL16F1200	Legal Writing and Legal Methods	HC	3	1	0	4
BBBL16F1300	General English	FC	3	1	0	4
BBBL16F1400	Principles of Management	HC	2	1	0	3
BBBL16F1500	Business Environment	HC	2	1	0	3
BBBL16F1600	Information Technology Fundamentals	FC	2	1	1	4
	TOTAL					**22**
SECOND SEMESTER						
BBBL16F2100	Legal and Constitutional History	HC	2	1	0	3
BBBL16F2200	Organizational Behaviour	HC	2	1	0	3
BBBL16F2300	Economic Development and Policies in India	HC	3	1	0	4
BBBL16F2400	Marketing Management	HC	2	1	0	3
BBBL16F2500	Financial Accounting	HC	2	0	1	3
BBBL16F2600	Communicative English	HC	2	1	0	3
BBBL16F2700	Legal Language and Communication	HC	1	0	1	2
	TOTAL					**21**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the III semester)						

THIRD SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F3100	Law of Torts including MV accident and Consumer Protection Laws	HC	3	1	0	4
BBBL16F3200	Law of Crimes – I: Penal code	HC	3	1	0	4
BBBL16F3300	Law of Contract – I	HC	3	1	0	4
BBBL16F3400	Constitutional Law – I	HC	3	1	0	4
BBBL16F3500	Cost and Management Accounting	HC	2	1	0	3
BBBL16F3600	Human Resource Management	HC	2	1	0	3
BBBL16F3700	Business Policy and Strategic Management	HC	2	1	0	3
BBBL16F3800	Summer Internship (Evaluation)	HC	0	0	2	2
	TOTAL					**27**

*Marks allocation for the report submission of summer training undertaken at the end of II semester with a corporate Lawyer or Law Firm.

FOURTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F4100	Family Law – I	HC	3	1	0	4
BBBL16F4200	Constitutional Law – II	HC	3	1	0	4
BBBL16F4300	Law of Contract - II	HC	3	1	0	4
BBBL16F4400	Jurisprudence – I	HC	3	1	0	4
BBBL16F4500	Financial Management	HC	2	1	0	3
BBBL16F4600	Corporate Planning and Project Management	HC	2	1	0	3
BBBL16F4700	International Business Law	HC	2	1	0	3
BBBL16F4800	Moot Court	HC	0	0	2	2
	TOTAL					**27**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the V semester)						

FIFTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F5100	Administrative Law	HC	3	1	0	4
BBBL16F5200	Labour and Industrial Law – I	HC	3	1	0	4
BBBL16F5300	Family Law – II	HC	3	1	0	4
BBBL16F5400	Company Law	HC	3	1	0	4
BBBL16F5500	Public International Law	HC	3	1	0	4
BBBL16F5600	Jurisprudence-II	HC	3	1	0	4
BBBL16F5700	Summer Internship (Evaluation)	HC	0	0	2	2
BBBL16F5800	Moot Court	HC	0	0	2	**2**
	TOTAL					**28**
Marks allocation for the report submission of summer training undertaken at the end of fourth semester with a corporate Lawyer or Law Firm.						

SIXTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F6100	Law of Crimes-II Criminal Procedure Code	HC	3	1	0	4
BBBL16F6200	Environmental Studies and Environmental Law	HC	3	0	1	4
BBBL16F6300	Civil Procedure Code and Limitation Act	HC	3	1	0	4
BBBL16F6400	Investment and Competition Law	HC	3	1	0	4
BBBL16F6500	Labour and Industrial Law – II	HC	3	1	0	4
Soft Core Courses (choose any **ONE** Course out two Courses given below)						
BBBL16F6610	Human Rights Law	SC	2	1	0	3
BBBL16F6620	Cyber Law	SC	2	1	0	3
BBBL16F6700	Moot Court	HC	0	0	2	2
	TOTAL					**25**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the VII semester)						

SEVENTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F7100	Law of Evidence	HC	3	1	0	4
BBBL16F7200	Property Law	HC	3	1	0	4
BBBL16F7300	Professional Ethics and Professional Accounting System	HC	3	1	0	4
BBBL16F7400	Client Interviewing Counseling & Advocacy Skills	HC	3	1	0	4
BBBL16F7500	Taxation Law/Principles of Taxation (Direct Tax)	HC	3	1	0	4
BBBL16F7600	Open Elective	OE	3	0	1	4
BBBL16F7700	Summer Internship (Evaluation)*	HC	0	0	2	2
BBBL16F7800	Moot Court	HC	0	0	2	2
	TOTAL					**28**
*Marks allocation for the report submission of summer training undertaken at the end of **VI semester** with a corporate Lawyer or Law Firm.						

*OE= to be offered by School of Legal Studies

EIGHTH SEMESTER

Course Code	Course Title	HC/SC /FC/OE	Credits			
			L	T	P	Total
BBBL16F8100	Drafting Pleading and Conveyance	HC	3	1	0	4
BBBL16F8200	Intellectual Property Law	HC	3	1	0	4
BBBL16F8300	Quantitative Practice & Business Statistics	HC	2	1	0	3
BBBL16F8400	Interpretation of Statutes	HC	3	1	0	4
Soft Core	**Choose any TWO of the following**					
BBBL16F8510	Banking & Insurance Law	SC	2	1	0	3
BBBL16F8520	Women and Law	SC	2	1	0	3
BBBL16F8530	Media Law	SC	2	1	0	3
BBBL16F8540	Health Care Law	SC	2	1	0	3
BBBL16F8600	Moot Court	HC	0	0	2	2
	TOTAL					**23**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the IX semester)						

NINTH SEMESTER

Course Code	Course Title	HC/SC /FC/OE	Credits			
			L	T	P	Total
BBBL16F9100	Alternate Dispute Resolution	HC	3	1	0	4
BBBL16F9200	Indirect Tax Law	HC	3	1	0	4
BBBL16F9300	International Trade Law	HC	3	1	0	4
BBBL16F9400	Research Methodology (Presentation of Research Papers and Seminars)	HC	0	0	3	3
Soft Core	**Choose any TWO of the following**					
BBBL16F9510	International Economic Law	SC	2	1	0	3
BBBL16F9520	Air & space Law	SC	2	1	0	3
BBBL16F9530	International Humanitarian and Refugee Law	SC	2	1	0	3
BBBL16F9540	Criminology	SC	2	1	0	3
BBBL16F9600	Summer Internship (Evaluation)	HC	1	1	0	2
	TOTAL					**23**
Marks allocation for the report submission of summer training undertaken at the end of **VIII semester** with a corporate Lawyer or Law Firm.						

TENTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
BBBL16F1010	Dissertation	HC	0	0	16	16

BBA LLB PROGRAM
DETAILED SYLLABUS

FIRST SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F1100	**Economic Development in India**	HC	3	1	0	4

Course Objectives:
The course is developed keeping in view the dynamics of economic principles in legal system. The Course intends to describe economic development in relation to Agriculture, Industry and Banking, the national income and the functions of the Central Bank i.e., RBI and the impact of globalization on the economy.

Course contents:
UNIT – 1
Introduction to Economics- Basic concepts and percepts- economic problems, economic rationality, optimality, demand and supply.

Economic Development in India, in relation to Agriculture, Industry and Banking since 1990

UNIT – 2
National Income – meaning, measurement and difficulties, Theory of Money and Banking – inflation and deflation, Principles of Public Finance- Parallel Economy – meaning, magnitude & consequences, Factors responsible for the generation of black money, Policy to control parallel economy.

UNIT – 3
Functions and role of RBI and monetary policy, Quantitative and selective methods – working of the Indian monetary system – Chakravarty committee report.

UNIT – 4
New Industrial policy, changing role of public sector small sector industrial policy, Abid Hussein committee report on SSI Globalization and its impact on Indian Economy, Emerging trends in India's Foreign Trade – Exim Policy – India and WTO, World Bank and IMF.

Text Books:
1. Indian Economy – A. N. Agarwal
2. Indian Economics – Shankaran
3. Indian Economy – Rudradutt, KPM Sundaram
4. Indian Economy – S. M. Mishra, V. K. Puri
5. Dwivedi, D.N. Macroeconomics; Tata Mc Graw Hill

Reference Books:
1. Dewett, K.K. Modern Economic Theory;
2. Seth. M.L. Money, Banking, International Trade and Public Finance

Course Code	Course Title		L	T	P	Total
BBBL16F1200	**Legal Writing and Legal Methods**	HC	3	1	0	4

Course Objectives:

This course seeks to enable students to identify, analyse and research issues in any area of law. The course will serve to equip students with basic skills necessary to navigate the law related courses and activities.

Course mandates: Each student has to submit

a. Case analyses Assignment
b. Research Assignment
c. Research Presentation

Course Contents:

Unit-1: Introduction to Law and its Classification

a. What is Law? – Introduction to Law, Its Functions
b. Classification:
    i. Public and Private Law
    ii. Substantive and Procedural Law
    iii. Municipal and International Law
c. Categorization: Different Legal Systems

Unit-2: Sources of Law

a. Custom
b. Precedent
c. Legislation
d. Constitution

Unit 3: Basic Concepts of Indian Legal System

a. Common Law
b. Constitution as Fundamental Law
c. Rule of Law
d. Separation of Powers
e. Judicial System in India

Unit-4: Legal Writing and Legal Research

a. Using a Law Library
b. Primary and Secondary Sources
c. Reading, Interpreting, Analyzing Law:
    i. Case Law
    ii. Statutes

iii. Reports, Journals, Manual, Digests etc.

d. Basic Legal Research
   i. Importance of Legal Research
   ii. Techniques of Legal Research (Identifying legal issue, finding relevant legal resources, finding statute, finding case-law, online resources.
   iii. Referencing, Footnoting, Citation

e. Legal Writing (Framing of Write up; Research Question, Title, Hypothesis, Identifying relevant areas of law, Literature, Case Law, Analyses, Discussion, Recommendation, Conclusion)

Text Books:

1. Glanville Willains – Learning the Law
2. Nomita Aggarwal – Jurisprudence (Legal Theory)
3. B.N.M. Tripathi – An Introduction to Jurisprudence and Legal theory.
4. TusharKantiSaha – Legal methods, Legal system
5. S C Srivastava and LL Bhatia – Legal methods, Legal systems

References:

1. Benjamin N.Cardozo, The Nature of Judicial Process
2. ILI Publication – Indian Legal System
3. ILI Publication in Legal Research and Methodology

Course Code	Course Title		L	T	P	Total
BBBL16F1300	**General English**	FC	3	1	0	4

Course Objective:

To develop a student capability to write and speak in English correctly

Course Contents:

Unit–1: Grammar and Usage

a. Tense and Composition
b. Basic Transformations
   i Active/Passive
     Negatives
   ii Questions
c. Simple, Complex and Compound Sentences
d. Reported Speech
e. Some Common errors

Unit – 2: Listening and Speaking Skills

a) Introducing one self and others –
   i. Formal
   ii. Informal
b) Giving and taking directions

Unit – 3: Reading and Writing Skills

a) Reading Comprehension
   i. General Reading
   ii. Legal Text
b) Paragraph and Précis writing
c) Formal Correspondence
d) Note Taking
e) Drafting of Reports and Projects
f) Abstracts

Unit–4: Reading Text
Silence: The Court is in Session (Vijay Tendulkar)

Text Books:

1. Legal Language and Legal Writing – P.K. Mishra
2. English Grammar – Wren and Martin

Reference:

1. Legal Language, Writing and General English – J.S. Singh

Course Code	Course Title		L	T	P	Total
BBBL16F1400	**Principles of Management**	HC	2	1	0	3

Course Objective:
To provide fundamental knowledge and exposure to the concepts, theories and practices in the field of management.

Course Contents:
Unit-1
Introduction: Concept, nature, process and significance of management; Managerial levels, skills, functions and roles; Management vs. Administration; Coordination as essence of management; Development of management thought: classical, neo-classical, behavioural, systems and contingency approaches.

Unit-2
Planning: Nature, scope and objectives of planning; Types of plans; Planning process; Business forecasting; MBO; Concept, types, process and techniques of decision-making; Bounded Rationality.
Organizing: Concept, nature, process and significance; Principles of an organization; Span of Control; Depart mentation; Types of an organization; Authority-Responsibility; Delegation and Decentralization; Formal and Informal Organization

Unit- 3
Staffing: Concept, Nature and Importance of Staffing
Motivating and Leading: Nature and Importance of motivation; Types of motivation; Theories of motivation-Maslow, Herzberg, X, Y and Z; Leadership – meaning and importance; Traits of a

leader; Leadership Styles – Likert's Systems of Management, Tannenbaum & Schmidt Model and Managerial Grid.

Unit- 4

Controlling: Nature and Scope of control; Types of Control; Control process; Control techniques – traditional and modern; Effective Control System.

Text Books:

1. Stoner, Freeman and Gilbert Jr.; Management. Prentice Hall of India, New Delhi
2. Gupta, C.B.; Management Concepts and Practices. Sultan Chand and Sons, New Delhi

References:

1. Koontz. O Donnel and Weirich– Management. Tata McGraw Hill Publishing Company, New Delhi.
2. Chopra, R.K. - Principles & Practices of Management. Sun India Publication, Latest Edition.
3. Tripathi P.C. and Reddy P.N., Principles & Practices of Management, Tata McGraw Hill.

Course Code	Course Title		L	T	P	Total
BBBL16F1500	**Business Environment**	FC	2	1	0	3

Course Objective:

To acquaint students with the business environment in terms of various laws, forces and regulatory measures governing business operations in India

Course Contents:

Unit – 1: Business Environment:

Nature and Significance, interaction matrix of different environment factors, process of environmental scanning, basic philosophies of capitalism and socialism with their variants.

Unit- 2: Regulatory Business Laws:

Industrial and Licensing Policy (latest), Foreign Exchange Management Act, Consumer Protection Act, Environment Protection Act, New Competition Law, Securities and Exchange, Board of India and Investor's Protection.

Unit- 3: New Economic Environment:

Liberalization, Privatization and Globalization of Indian Economy: Trends and issues

Unit-4: Monetary and Fiscal Environment in India:

Monetary and Fiscal Policies; their working, latest trends and issues

Text Books:

1. Bedi, Suresh - Business Environment, Excel Books, New Delhi.
2. Mishra, S.K. and Puri, V.K.-Economic Environment of Business, Himalaya Publishing House, New Delhi.
3. Paul, Justin - Business Environment (Text and Cases), Tata McGraw-Hill, New Delhi
4. Economic Survey, Government of India (Latest)
5. Monthly Bulletins, Reserve Bank of India, Mumbai

Course Code	Course Title		L	T	P	Total
BBBL16F1600	**Information Technology Fundamentals**	FC	2	1	1	4

Course Objective:

To familiarize the students with the computers, operating system, networking, and use of computers in data processing.

Course Contents:

Unit – 1: Basics of Computer and its evolution

Evolution of Computer, Data, Instruction and Information, Characteristics of computers, various fields of application of computers, various fields of computer (Hardware, Software, Human ware and Firmware), Advantages and Limitations of computer, Block diagram of computer, Function of different Units of computer, Classification of computer (i) On the basis of technology (Digital, Analog and Hybrid) (ii) On the basis of processing speed and storage capacity (Micro, Mini, Mainframe and Super) (iii). On the basis of Purpose (General & Special) Different Generation of computes (I to V), Types of software (System and Application), Compiler and Interpreter, Generation of Language (Machine Level Assembly, High Level, 4GL), Number Systems and their Inter-conversion.

Unit – 2: Input and Output Devices:

Keyboard, Mouse, Joystick, Digitizer, Scanner, MICR, OCR, OMR, Light Pen, Touch Screen, Bar Code Reader, Voice Input Device, Monitor and it's type (VGA, SVGA and XGA), Printer and it's type (Impact and Non-Impact with example), Plotter.

Computer Memory:

Primary Memory (ROM and it's types – PROM, EPROM,EEPROM, RAM) Secondary memory-SASD, DASD Concept, Magnetic Disks – Floppy disks, Hard disks, Magnetic Tape, Optical disks– CD ROM and it's types (CD ROM, CD ROM-R, CD ROM-EO, DVD ROM Flash Memory.

Unit- 3: Operating System Concept:

Introduction to operating system; Function of OS, Types of operating systems, Booting Procedure, Start-up sequence, Details of basic system configuration, Important terms like Directory, File, Volume, Label, Drive name, etc.

Introduction to GUI using Windows Operating System

All Directory Manipulation: Creating directory, Sub directory, Renaming, Copying and Deleting the directory.

File Manipulation: Creating a file, deleting, copying, and renaming a file.

Unit-4: Concept of Data Communication and Networking:

Networking concepts, Types of Networks (LAN, MAN, WAN), Communication Media, Mode of Transmission (Simplex, Half Duplex and Full Duplex), Analog and Digital Transmission, Network Topologies, Internet, Intranets, Extranets, Inter-networking devices

Office Productivity Software: Introduction to Word Processing, Spreadsheets and Presentation Software; Database management concepts, Comparison with Traditional File systems, DBMS Models and Concept of keys; Data Security concepts

Text Books:

1. Turban, Rainer and Potter- Introduction to Information Technology. John Wiley & Sons.
2. Saini, A.K. and Pradeep Kumar - Computer Applications in Management, Anmol Publications, N. Delhi.

3. ITL Education Solutions Ltd. -Introduction to Information Technology, Pearson Education.

Reference:

1. Sinha, Kr. Pradeep and Preeti Sinha; Foundations of Computing, BPB Publication, Latest Edition.

SECOND SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F2100	**Legal and Constitutional History**	HC	2	1	0	3

Course Objectives:

1. To give historical overview of early legal and constitutional developments in India.
2. To familiarize students with the evolution of law and legal institutions.
3. To give an understanding of different acts came into being in the late 18th and early 19th century.

Course Contents:

Unit-1

Early Developments (1600-1836)

Charters of the East India Company: 1600, 1661,
Settlements: Surat, Madras, Bombay and Calcutta
Courts: Mayor's Court of 1726 and Supreme Court of 1774

Unit-2

Statutes: Regulating Act, 1773, Pitts India Act, 1784, the Act of Settlement, 1781 Conflict: Raja Nand Kumar, Patna Case and Cossijurah
Warren Hastings: Judicial Plans of 1772, 1774 and 1780
Lord Cornwallis: Judicial Plans of 1787, 1790 and 1793
Lord William Bentinck (With special focus on Appraisal of Criminal Law)

Unit-3

Evolution of law and legal institutions

Development of law in Presidency Towns
Development of Civil law in Mufassil: Special emphasis on justice, equity and good conscience
Codification of laws: Charter of 1833, the First Law Commission, the Charter of 1853, The Second Law Commission
Establishment of High Courts, 1861
Privy Council and Federal Court: Appeals and working of Privy Council Evaluation: Special Reference to Racial Discrimination, Merit and Demerits

Unit-4

The Indian Councils Act, 1861
The Indian Councils Act, 1892
The Indian Councils Act, 1909
The Government of India Act, 1919
The Government of Indian Act, 1935 (Nature and characteristics under the Act, Executive Powers of Governor General, Federal Legislature, Federal Court)
Indian Independence Act 1947

Books for Reference:

1. Jain, M. P: Outlines of Indian Legal History
2. Keith, A.B: Constitutional History of Indian (1973), Chapters VII, VIII, X,XI and XII only.
3. Banerjee, A. C: The Making of the Indian Constitution
4. Jois, M. Rama: Legal History of India
5. Kulshrashtha, VD: Landmarks in Indian Legal and Constitutional History. Jain, M. P: Bharatka VidhikaItihas
6. Mittal,J. K.: Bharat ka Vaidhanikavam Samvedhanik Itihas

Course Code	Course Title		L	T	P	Total
BBBL16F2200	**Organizational Behaviour**	HC	2	1	0	3

Course Objective:
To provide an understanding of basic concepts, theories and techniques in the field of human behavior at the individual, group and organizational levels in the changing global scenario.

Course Contents:
Unit-1
Introduction: Concept and nature of organizational behaviour, contributing disciplines to the field of O.B; O.B Models; need to understand human behaviour, challenges and opportunities.

Unit-2
Individual & Interpersonal Behaviour: Biographical Characteristics; Ability: Values: Attitudes-Formation, Theories, Organisation related attitude, Relationship between attitude and behaviour; Personality – determinants and traits; Emotions; Learning-Theories and reinforcement schedules, Perception – Process and errors.
Interpersonal Behaviour; Johari Window; Transactional Analysis – ego states, types of transactions, life positions, applications of T.A

Unit-3
Group Behaviour and Team Development: Concept of Group and Group Dynamics; Types of Groups; Formal and Informal Groups; Stages of Group Development, Theories of Group Formation; Group Norms, Group Cohesiveness; Group Think and Group Shift. Group Decision Making; Inter Group Behaviour, Concept of Team Vs. Group; Types of teams; Building and Managing effective teams.
Case Study

Unit-4
Organization Culture and Conflict Management; Organizational Culture-Concept, Functions, Socialization; Creating and sustaining culture; Managing Conflict – Sources, types, process and resolution of conflict; Managing Change; Managing across Cultures; Empowerment and Participation.
Case Study

Text Books:
1. Prasad, L.M -Organizational Behavior, Sultan Chand & Sons.
2. Stephen P. Robbins -Organizational Behavior; "Prentice Hall of India Pvt. Ltd.," New Delhi.

References:
1. Luthans, Fred - Organizational Behavior, Tata McGraw Hill, New Delhi.
2. Chabbra T.N & Singh, B.P, Organization Behavior, Sultan Chand & Sons.
3. Khanka S.S; Organizational Behavior, Sultan Chand and Sons, New Delhi, Latest Edition.
4. Joseph, Weiss - Organization Behaviour and Change, Vikas Publishing house.

Course Code	Course Title		L	T	P	Total
BBBL16F2300	**Economic Development and Policies in India**	HC	3	1	0	4

Course Objective:

To review major trends in aggregate economic indicators in India and place these against the backdrop of major policy debates in India in the post-Independence period

Course Outcomes:

- The students will possess knowledge of aggregate economic indicators and the major trends in India;
- They are exposed to demographic trends, urbanization and such other issues relating to economic development;
- They will have the knowledge of employment occupational structure in different sectors, unemployment problems and employment schemes;
- They will understand and conceptualize inequality, poverty and other factors; and
- They also will be equipped with fiscal and monetary policies, economic reforms, state and central fiscal relations and so on.

Course Contents:

Unit-1

Issues in Growth, Development and Sustainability; Poverty, Business Cycles and Unemployment Factors in Development Capital formation (Physical and Human); technology; institutions

Unit-2

Population and Economic Development Demographic trends; urbanization, Employment Occupational structure in the organized and the unorganized sectors; open-, under- and disguised unemployment (rural and urban); employment schemes and their impact.

Unit-3

Indian Development Experience Critical evaluation of growth, inequality, poverty and competitiveness, pre and post reforms era; savings and investment; mobilization of internal and external finance; monetary and fiscal policies; centre-state financial relations. Central budget, burden of deficits and debts.

Unit-4

Agriculture: Policies and Performance Production and productivity; credit; labour; markets and pricing; land reforms; regional variations.

Industry: Production Analysis, costs and market structure**,** Policies and Performance Production trends; small scale industries; public sector; foreign investment.

Foreign Trade: Trends and Policies Balance of trade and balance of payments; India and the World Trade Organisation.

Readings:

1. Michael P Todaro and Stephen Smith (2011). Economic Development. Pearson, 11th edition.
2. Uma Kapila (2009). Indian economy since independence. Academic Foundation, 19th edition.

3. United Nations Development Programme, Human Development Report 2010, Palgrave Macmillan
4. Government of India, Economic Survey (latest)
5. Government of India, Five Year Plan (latest)
6. Government of India, Finance Commission Report (latest)
7. Samuelson Economics
8. Bilas Microeconomic theory; Mc Graw Hill International Edition

Course Code	Course Title		L	T	P	Total
BBBL16F2400	**Marketing Management**	HC	2	1	0	3

Course Objective:
To aim at making students understand concepts, philosophies, processes and techniques of managing the marketing operations of a firm.

Course Contents:

Unit-1
Introduction to Marketing
Meaning, Nature and Scope of Marketing; Marketing Philosophies; Marketing Management Process; Concept of Marketing Mix; Market Analysis; Understanding Marketing Environment; Consumer and Organisation Buyer Behaviour; Market Measurement; Market Segmentation, Targeting and Positioning

Unit-2
Product Planning and Pricing
Product Concept; Types of Products; Major Product Decisions; Brand Management; Product Life Cycle, New Product Development Process; Pricing Decisions; Determinants of Price; Pricing Process, Policies and Strategies.

Unit-3
Promotion and Distribution decisions
Communication Process; Promotion, Tools-Advertising, Personal Selling, Publicity and Sales Promotion; distribution Channel Decisions – Types and Functions of Intermediaries, Selection and Management of Intermediaries

Unit –4 Marketing Organization and Control
Emerging Trends and Issues in Marketing – Consumerism, Rural Marketing, Social Marketing; Direct and Online Marketing; Green Marketing

Text Books:
1. Kotler, Philip.- Marketing Management: Analysis, Planning, Implementation & Control, Prentice Hall of India.
2. Michael, J. E., Bruce, J. W. and William, J. S.-Marketing Management, Tata McGraw-Hill, New Delhi

References:
1. Louis E.Boone and David L.Kurtz -Contemporary Marketing, Harcourt, Collye Publishers
2. Douglas, J. Darymple& Leonard J. Parsons- Marketing Management: Text and Cases. Seventh Edition, John Wiley and Sons.
3. Pride, William, M., and O.C. Ferrell- Marketing: Concepts and Strategies. Biztantra, New Delhi

Course Code	Course Title		L	T	P	Total
BBBL16F2500	**Financial Accounting**	HC	2	0	1	3

Course Objective:
The object of this course is to acquaint students with the accounting concepts, tools and techniques influencing business organization and also to acquire conceptual knowledge of financial accountancies and to import skills for recording various kinds of business transaction.

Course Contents:

UNIT 1: INTRODUCTION TO FINANCIAL ACCOUNTING.

INTRODUCTION-Meaning, Definition, objectives of accounting-functions of accounting-uses of accounting information-limitations of accounting –accounting principles-accounting concepts and accounting conventions. Accounting standards, list of Indian accounting standards (IAS)

UNIT 2: ACCOUNTING PROCESS

Meaning-Process of accounting, - kinds of account- rules-Transaction Analysis – Journal Ledger, Balancing of Accounts, Trail balance Problems.

UNIT 3: SUBSIDIARY BOOKS

Meaning- Types Subsidiary Books Purchases book-sales book-Purchases return book-Sales returns Book-Bills receivable book, Bills Payable book-cash book (Simple, Double, Three Column cash book and petty cash book.

UNIT 4: FINAL ACCOUNTS OF PROPERTY CONCERN
Preparation n of final accounts, Trading, Profit and loss account and Balance Sheet (Vertical form)

SKILL DEVELOPMENT:
1. List out the accounting concepts and Conventions.
2. Collect the final Accounts of a proprietary concern and prevent it in verbal form.
3. List out Varies Accounting Standards.

Text Books:-
1. Dr.S.M.Maheswari:-Financial Accounting, Vikas Publications.
2. S.P.Jain and K.L.Narang:-Financial Accounting-I, Kalyani Publishers.
3. Jawaharlal and Seema Srivastava :-Financial Accounting, HPH.
4. Grewal and Gupta:-Advanced Accounting, Sultan Chand.
5. R.G .Saha :- Fundamentals of Accounting, HPH.
6. Hongren-Introduction of Financial Accounting, Pearson Education.

References:
1. Monga, J.R. and Girish Ahuja- Financial Accounting, Eighteenth Edition, Mayoor Paper Backs.

2. Bhattacharya, S.K. and J. Dearden - Accounting for Manager – Text and Cases, Third Edition, Vikas Publishing House.
3. Maheshwari, S.N. and S.K. Maheshwari - Advanced Accountancy, Eighth Edition, Vol.I & II, Vikas Publishing House.

Course Code	Course Title		L	T	P	Total
BBBL16F2600	**Communicative English**	HC	2	1	0	3

Course Objectives:
Students are to be equipped in the communication skills that are necessary for making oneself a good business administrator. Students are also required to be trained in computer communication skills to the extent necessary for a graduate I business administration so that he will be able to handle e-business.

Course Contents:

Unit –1
Communication - meaning, history and importance communicators and subject matter of communication - models of communication- written, oral and body language - Benefit of communication.

Unit – 2
Business communication- need for business communication errors in communication namely wrong communication, partial communication and no communication- Pre-requisites of good business communication.

Unit– 3
Business Letters - enquiries, quotations, orders and complaints, response, Announcements- Characteristics of a good business letter.

Unit – 4
Reports- Reports for publication, periodical reports- reports to shareholders, Board of Directors Reports- reports to Creditors- Auditors reports- Reports of investigations and enquiries.
Press notes and speeches of the Chairperson in company meetings.

Text Book:
1. M.S. Ramaiah & Puttanashatty- Business Communications (Himalaya Publishing House, Bangalore).

Course Code	Course Title		L	T	P	Total
BBBL16F2700	**Legal Language and Communication**	HC	1	0	1	2

Course Objective:
To develop a student capability to understand the Legal context importance in the practical implementation of Law

Course Contents:
Unit–1: Legal Maxims and Legal Phrases

a) Legal Maxim

Actio Personalis Moritur Cum Persona; Actus Nemini Facit Injuriam; Actus Non Facit Reum Nisi Mens Sit Rea; Audi Alteram Partem; Boni Judicis Est Judicium

Sine Dilatione Mandare Executioni; Delegate Non Potest Delegare; Duo Non Possunt In SolidoUnam Rem Possidere; Ex NudoPactoActio Non Oritur; Executio Legis Non Habet Injuriam; Firmior Et Potentior Est Operatio Legis Quam Dispositio Hominis; Generale Nihil Certum Implicat; Ignorantia Facti Excusat, Ignorantia Juris Non Excusat; In Criminalibus Probationes Debent Esse Luce Clariores; In Jure Non Remota Causa Sed Proxima Spectator; In Verbis, Non Verba Sed Res Et Ratio Quaerenda Est; Juramentum Est Indivisible Et Non Est Admittendum In Parte Verum Et In Parte Falsum; Lex Non Requirit Verificari Quod Apparet Curiae; Mors Dicitur Ultimum Supplicium; Non Facias Malum UtInde Veniat Bonum; Quod Constat Curiae Opere Testium Non Indigent; Ratio Est Legis Anima, Res Ipsa Loquitor; Sententia InterlocutoriaRevocari Potest, Definitiva Non Potest; Ubi Jus Ibi Remedium Est; Vigilantibus Non Dormientibus Jura Subveniunt; Volenti Non Fit Injuria.

b) Legal Phrases

Ab initio, Actus reus; Actioneslegis; Amicus curiae; Ad hoc; Aularegis ; Bona fide; Caditquaestio; Caveat emptor; Caveat venditor; Corpus delicti; Custosmorum; De facto; De jure; Dominium; Ex facie; Ex gratia; Ex parte; Ex post facto; Faciendum; Idem; In camera; In delicto; In omnibus; Inter alia; Ipso facto; Jus natural; Mala fide; Mala prohibita; Mandamus; Mens rea; Mutatis Mutandis; Non sequitur; Obiter Dicta; Par delictum; Per curiam; Post mortem; Prima facie; Pro rata; Publici juris; Quid pro quo; Res gestae; Sub modo; Sui generis; Terra firma; Verbatim; Vice versa.

Unit – 2: Legal Official Words and Terminology and Foreign Words

a) Legal Official Words and Terminology

b) Foreign Words

Unit–3: **Common Hindi and Urdu words used in Courts and Translation**

a) Common Hindi and Urdu words used in Courts

b) Translation from Hindi to English and Vice Versa

Unit–4: Drafting of Moot Memorials

a) Drafting A Memorial

Table of Contents; List of Abbreviations; List of Sources; Statement of Relevant Facts; Issues; Summary of Arguments; Jurisdiction of the Court; Arguments; Submissions.

b) Requirements Regarding the Format of a Memorial

Memorial in English; Penalty: disqualification of the team; Order of sections and all sections included; Table of Contents, List of Abbreviations, List of Sources (treaties, jurisprudence, literature, etc.), Statement of Relevant Facts, Issues, Summary of Arguments, Jurisdiction of the Court, Argument, and Submissions.

Text Books:

1. Legal Language and Legal Writing – P.K. Mishra
2. Legal Language and Legal Writing – Dr. S.R. Myneni
3.

Reference:

1. Legal Language, Writing and General English – J.S. Singh

THIRD SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F3100	**Law of Torts including MV accident and Consumer Protection Laws**	HC	3	1	0	4

Course Objective:
To make students understand the nature of tort and conditions of liability with reference to established case law. Further, it covers the Consumer Protection Act, 1986.

Course Contents:

Unit – 1: Introduction and Principles of Liability in Tort

a. Definition of Tort
b. Development of Tort actions in England and India – Tort distinguished from contract, Quasi-contract and crime
c. Constituents of Tort – Wrongful Act, Damage and Remedy
d. Strict Liability and Absolute Liability
e. Vicarious Liability – Scope and Justification
f. Doctrine of Sovereign Immunity

Unit – 2: Justification in Tort

a. Volenti non-fit Injuria
b. Necessity, Plaintiff's default
c. Act of God
d. Inevitable accidents
e. Private defences
f. Judicial and Quasi – Judicial Acts
g. Parental and quasi-parental authority

Unit – 3: Specific Torts

a. Defamation
b. Negligence
c. Nuisance
d. Assault, battery and mayhem
e. False imprisonment and malicious prosecution
f. Nervous Shock

Unit - 4: MV accident and Consumer Protection Laws

MV accident –

i. Remedies Liability under Motor Vehicles Act 1988
i. Compensation in Motor Vehicle Accidents
ii. Nature and extent of insurer's liability
iii. Award of compensation

Consumer Protection Laws -Basic Concepts: Consumer, Service, Goods

i. Authorities for consumer protection
ii. Remedies

Text books:

1. Tort: Winfield and Jolowicz
2. The Law of Torts: Ratanlal&Dhirajlal

Essential Case Law:

1. Bhim Singh v. State of J & K and Others
2. RudulSah v. State of Bihar
3. Rylands v. Fletcher 1868 LR HL 330
4. M.C. Mehta v. Union of India 1987 1 SCC 395
5. Union Carbide Corporation v. Union of India AIR 1989 SC 248
6. Donoghue v. Stevenson 1932 SC 31
7. State of Rajasthan v. Mst. Vidyawati& Others AIR 1962 SC 1039
8. M/s KasturilalRaliaRam Jain v. State of U.P. AIR 1965 SC 1039
9. Cassidy v. Daily Mirror Newspapers Ltd.
10. Bird v. Jones 1845 7 QB 742
11. Lucknow Development Authority v. M.K.Gupta, (19494) ISCC 243.
12. A.C. Modagi v. cCrosswell Tailor, (1991) II CPJ 586
13. Indian Medical Assn. v. V.P. Shantha (1995) 6 SCC 651
14. Consumer Unity and Trust society v. St. of Rajasthan (1991) II CPJ 56 Raj.
15. Poonam Verma v. Ashwin Patel (1996) 4SCC 332
16. LaxmiEngg. Works v. P.S.G. Indutrial Institute, AIR (1995) SC 1428
17. Spring Meadows Hospital v. Harjol Ahluwalia, AIR (1998) SC 1801
18. Morgan Stanley Mutual Fund v. Kartick Das (1994) 4SCC 225

Course Code	Course Title		L	T	P	Total
BBBL16F3200	**Law of Crimes – I: Penal code**	HC	3	1	0	4

Course Objectives:

To focus on the study of substantive crimes under the Indian Penal Code

Course Contents:

Unit – 1: Offences affecting the Human body

a. Offences affecting life, causing miscarriage, or injuries to unborn children
b. Offences of hurt, of wrongful restraint and wrongful confinement
c. Offences of criminal force and Assault, offences of kidnapping and Abduction

Unit – 2: Offences against Women

a. Obscene acts and songs
b. Outraging the modesty of women
c. Rape
d. Cruelty by husband or relatives of husband
e. Offences relating to marriage

Unit – 3: Offences against Property

a. Theft, Extortion, robbery and dacoity
b. Criminal misappropriation and criminal breach of trust

c. Cheating
d. Mischief
e. Criminal trespass

Unit- 4: Defamation and offences relating to documents and property marks

a. Defamation
b. Forgery
c. Counterfeiting

Text books:

1. Ratanlal and Dhirajlal – The Indian Penal Code
2. H.S. Gaur – Penal Law of India
3. Kennys Outlines of Criminal Law

Essential Case Law:

1. Govinda's Case – (1876), Bom 342
2. State of A.P. v. R. Punnayya – 1977 Cr LJ 1(SC)
3. K.M. Nanavati v. State of Maharashtra – 1962 (Bom) LR 488 (SC) - AIR 1962 SC 605
4. Bachan Singh v. State of Punjab (1980) 2 SCC 684
5. Shashi Nayar v. Union of India – 992 Cr LJ 514
6. Virsa Singh v. State of Punjab – AIR 1958 SC 465
7. Harjinder Singh v. Delhi Administration – AIR 1968 SC 867
8. Mahesh Balmiki v. State of M.P. – 2000 (1) SCC 319
9. Tukaram v. State of mahrashtra – AIR 1979 SC 185
10. State of Punjab v. Gurmit Singh – AIR 1996 SC 1393
11. Bodhisattwa Gautam v. Miss SubhraChakrabarty – AIR 1996 SC 922
12. BiswanathMallick v. State of Orissa – 1995 Cr LJ 1416 (Orissa)
13. State OF Madras v. Vardarajan – AIR 1965 SC 942
14. State of Haryana v. Raja Ram – AIR 1973 SC 819
15. Vishwanath v. State of U.P. – AIR 1960 SC 67
16. State of HP v. Nikku Ram – 1995 Cri LJ 4184 (SC)
17. P. Rathinam v. Union of India – AIR 1994 SC 1844
18. Gian Kaur v. State of Punjab – AIR 1996 SC 946
19. State v. Lekhraj – 2000 (1) SCC 247
20. SikharBehera v. State of Orissa – 1993 Cr LJ 3664
21. Dhananjai v. State of U.P. – AIR 1996 SC 556
22. Shanti v. State of Haryana
23. State of Kerala v. Mathai Verghese – (1986) 4 SCC 746

Course Code	Course Title		L	T	P	Total
BBBL16F3300	**Law of Contract – I**	HC	3	1	0	4

Course Objectives:

To make students familiar with various principles of contract formation enunciated in the Indian Contract Act, 1872.

Course Contents:

Unit – 1: Formation of Contract

a. Meaning and nature of contract
b. Offer / Proposal
   Definition
   Communication Revocation
   General/Specific offer Invitation to treat
c. Acceptance
   Definition
   Communication Revocation
   Tenders/Auctions

Unit – 2: Consideration and Capacity

a. Consideration
   Definition Essentials
   Privity of contract
b. Capacity to enter into a contract Minor's position Nature / effect of minor's agreements

Unit – 3: Validity, Discharge and Performance of Contract

a. Free Consent
b. Coercion, undue influence, Misrepresentation, Fraud, Mistake
c. Unlawful consideration and object
d. Effect of void, voidable, valid, illegal, unlawful and uncertain agreements contracts
e. Discharge of Contracts
f. Performance
g. Time and Place of performance
h. Impossibility of performance and frustration
i. Breach – Anticipatory & Present

Unit – 4: Remedies and Quasi Contracts

a. Remedies
   i Damages
   ii Kinds
   iii Remoteness etc.
   iv Injunction
   v Specific performance
   vi Quantum Merit
b. Quasi Contracts (Sections 68-72)

Text Books:

1. Avtar Singh – Law of Contract and Specific Relief
2. Mulla - Law of Contract and Specific Relief
3. Anson's - Law of Contract

References:

1. Cheshire and Fifoot - Law of Contract

Course Code	Course Title		L	T	P	Total
BBBL16F3400	**Constitutional Law – I**	HC	3	1	0	4

Course Objectives:

To provide understanding of basic concepts of Indian Constitution and various organs created by the constitution including their functions.

Course Contents:

Unit – 1: Constitution

a. Definition and Classification
b. Sources of Constitution
c. Constitutional Conventions
d. Salient features of Indian Constitution
e. Rule of Law
f. Separation of powers

Unit – 2: Distribution of Powers between Centre and States

a. Legislative Powers
b. Administrative Powers
c. Financial powers

Relevant Doctrines: (a) Territorial Nexus (b) Harmonious Construction (c) Pith and Substance (d) Repugnancy

Unit – 3: Constitutional Organs

a. Parliament
b. Parliamentary Sovereignty
c. Parliamentary Privileges
d. Anti-Defection Law
e. Executive Power
f. Collective Responsibility of Cabinet
g. Judiciary - Jurisdiction of Supreme Court and High Courts
h. Independence of Judiciary
i. Public Interest Litigation
j. Power of Judicial Review
k. Doctrine of Political Question

Unit – 4: Emergency Provisions

Amendment of Constitution
Doctrine of Basic Structure

Text books:

1. V.N. Shukla, Constitution of India
2. M.P. Jain – Indian Constitutional Law.
3. Nutshells – Constitutional and Administrative Law.

References:

1. D.D. Basu, Introduction to the Constitution of India
2. H.M. Seervai's, Constitutional Law of India, Latest Ed.
3. Arvind P. Datar on Constitution of India

Essential Case Law:

1. R.K. Dalmia v. Justice Tendulkar AIR 1958 S.C. 538
2. In Re Article 143, Constitutional of India AIR 1951 S.C. 332
3. Ram JawayaKapur v. State of Punjab AIR 1955 S.C. 549
4. Indira Gandhi v. Raj Narain AIR 1975 S.C. 2299
5. Scora v. U.O.I. 1993 (4) S.C.C. 441
6. State of H.P. v. Umed Ram Sharma AIR 1986 S.C. 847
7. S.R. Bommai v. Union of India, 1994(3) S.C.C. 1
8. A.D.M. Jabalpur v. Shiv Shankar Shukla, 1976 Suppl. S.C.R. 172
9. India Cements Ltd &Anr v. State of Tamil Nadu, 1990 (1) S.C.C. 12
10. A.P. Sampoorna Madhya NishedSamithi&Ors. v. State of A.P., AIR 1997 A.P. 312
11. U.N. Rao v. Indira Gandhi, AIR 1971 S.C. 1002
12. KeshavanadBharati v. State of Kerala, 1976(2) S.C.R. 347, 523
13. National Human Rights Commission v. State of Arunachal Pradesh, AIR 1996 S.C. 1234
14. Minerla Mills v. Union of India AIR 1980 S.C. 1804
15. SamtaVedike v. State of Karnataka 2003 CR.L.J. 1003 Kar N.C.
16. Tikaramji v. State of U.P. AIR 1968 S.C. 1286
17. Calcutta Gas Co. v. State of W.B. AIR 1962 S.C. 1044
18. Gujarat University v. Sri Krishna AIR 1963 SC 702
19. DAV College v. State of Punjab AIR 1971 SC 1737
20. Prafulla Kumar v. Pramil of Commerce AIR 1947 P.C. 60
21. State of Rajasthan v. G.Chawla AIR 1959 SC 544
22. Union of India &Ors. V. Shah Govardhan Lal Kabra 2000 (7) Scale 435
23. Zayerbhai v. State of Bombay AIR 1954 SC 752
24. Union of India v. V.H.S. Dhillon AIR 1972 SC 1061
25. Jayanti Lal Amrit Lal Rana v. F.N. Rana AIR 1964 S.C. 648
26. State of Haryana v. Ram Kishan AIR 1988 SC 1301
27. K. Nagraj v. State of A.P. 1985 (1) SCC 527
28. K.T. Plantantion v. State of Karnataka, AIR 2002 (Oct) Kar 365
29. Gunupati v. Nafisul Hasan AIR 1954 SC 636
30. Pandit MSM Sharma v. Sri Krishna Sinha AIR 1959 SC 395
31. In powers, privileges and Immunities of State Legislature Re: AIR 1965 SC 745
32. P.V. Narsimha Rao v. State 1998 (94) SCC 626
33. Tej Kiran v. Sanjiva Reddy AIR 1970 SC 1573
34. Roop Ashok Hurrah v. Ashok Hurrah 2002 (3) SCC 406
35. TirupathiBalaji Developers (P) Ltd. v. State of Bihar AIR 2004 SC 2351
36. A.K. Roy V. UOI 1982 (2) SCR 272
37. State of Maharashtra v. A. Lakshmirutty AIR 1987 SC 331
38. KihotoHollohah v. Zachillu 1992 Suppl (2) SCC 651
39. Ravi Naik v. UOI AIR 1994 SC 1558
40. G. Vishwanathan v. Speaker T.N. Assembly 1996 (2) SCC 353
41. M. KashinathJalmi v. Speaker Legislative Assembly Goa 1993 (2) SCC 703
42. D.C. Wadhwa v. State of Bihar 1987 (1) SCC 379

43. Krishan Kumar v. State of Bihar 1998 (5) SCC 643
44. Makhan Singh v. State of Punjab AIR 1964 SC 381

Course Code	Course Title		L	T	P	Total
BBBL16F3500	**Cost and Management Accounting**	HC	2	1	0	3

Course Objectives:

To enable the students to grasp the fundamentals of cost accounting and the tools used in cost accounting. To facilitate the students and to enrich knowledge about the financial statement analysis and management reporting practices

Course Contents

UNIT 1

Introduction: Meaning and definition of cost- Costing-Cost accounting and cost accountancy– Objectives and functions of cost accounting-Advantages of c osting-Differences between c ost a ccounting and financial accounting-Methods of costing (only theory).Cost Ascertainment: Cost center and cost unit - Elements of cost - Classification of cost - Components of total

UNIT 2

Material: Meaning and definition - Material control concept and techniques - Purchase department - Functions of purchase department - Centralized and decentralized purchase system Labor: Meaning and definition –Control of labor - T imekeeping and t ime - Booking departments- Methods of remuneration. Overheads–Meaning and d efinition – Classification of o v e r h e a d

UNIT 3:

Introduction: Meaning – Objectives – Nature and scope of management accounting – Role of management accountant – Relationship between financial accounting - Cost accounting and management accounting. Financial Statement Analysis: Meaning – Types –Meaning and concept of financial analysis – Types of financial analysis – Methods of financial analysis

UNIT 4:

Ratio Analysis: Meaning – Importance – Utility of ratios – Classification of ratios –.Funds Flow and Cash Flow Analysis**:** Meaning – Concept of fund and funds flow statement – Uses and significance of funds flow. Management Reporting

References:

1. Horngreen, Charles T., Foster, George, and Srikant M. Dattar, Cost Accounting: A Managerial Emphasis, Prentice Hall of India Ltd., New Delhi.
2. Lal, Jawahar and Seema Srivastava, Cost Accounting, Tata McGraw Hill Publishing Co., New Delhi.
3. Shukla, M.C., Grewal, T.S., and M.P. Gupta, Cost Accounting: Text and Problems, S. Chand & Co. Ltd., New Delhi.
4. Maheshwari, S.N. and S.N. Mittal, Cost Accounting: Theory and Problems, Shri Mahabir Book Depot, New Delhi.
5. S.P. Iyangar. Cost Accounting.

6. Jain and Narang, Cost Accounting, Kalyani Publishers, New Delhi
7. Khan, M.Y. and P.K. Jain, Management Accounting, Tata McGraw Hill, Publishing Co., New Delhi.
8. Horngren, Charles T. and, Gary L. Sundem, Introduction to Management Accounting, Prentice Hall.
9. Murthy. A and S GurusamyManagement Accounting, Tata McGraw Hill.
10. Arora, M.N, Management Accounting, Himalaya Publishing House.
11. Jhamb, H.V, Management Accounting, Ane Books Pvt. Ltd. New Delhi
12. Garrison H, Ray and Eric W. Noreen, Managerial Accounting, McGraw Hill.
13. Drury, Colin, Management and Cost Accounting, Thomson Learning.
14. Sexana V.A, Management Accounting, Sultan and Chand Publishing House, New Delhi.
15. Foster, Financial Management Analysis, Pearson

Course Code	Course Title		L	T	P	Total
BBBL16F3600	**Human Resource Management**	HC	2	1	0	3

Course Objective:
To familiarize students with the different aspects of managing Human Resources in the organization through the phases of acquisition, development and retention.

Course Contents

Unit – 1
Introduction: Concept, nature, scope, objectives and importance of HRM; Evolution of HRM; Challenges of HRM; Personnel Management vs HRM. Strategies for the New Millennium: Role of HRM in strategic management; human capital; emotional quotient; mentoring; ESOP; flexi-time; quality circles; Kaizen TQM and Six Sigma.

Unit – 2
Acquisition of Human Resources: HR Planning; Job analysis – job description and job specification; recruitment – sources and process; selection process – tests and interviews; placement and induction. Job changes – transfers, promotions/demotions, separations.

Unit – 3
Training and Development: Concept and importance of training; types of training; methods of training; design of training programme; evaluation of training effectiveness; executive development – process and techniques; career planning and development.

Unit – 4
Compensation and Maintenance: Compensation: job evaluation – concept, process and significance; components of employee remuneration – base and supplementary; Performance and Potential appraisal – concept and objectives; traditional and modern methods, limitations of performance appraisal methods, 360 degree appraisal technique; Maintenance: overview of employee welfare, health and safety, social security.

Text Books:
1. Chhabra, T. N (2003), Human Resource Management; Dhanpati Rai and Co. Pvt. Ltd New Delhi.

2. Dr. Gupta, C. B. (2003); Human Resource Management, Sultan Chand and Sons, New Delhi
3. K Aswathappa- Human Management and Personnel Management, Tata McGraw-Hill Education

References:

1. Flippo, Edwin B., Personnel Management, Tata McGraw Hill, latest edition.
2. Rao, V.S. P. - Human Resource Management, Test and Cases, Excel Books.
3. Aswathappa, K. - Human Resource and Personnel Management (Text and Cases), Tata McGraw Hill Publishing Company, New Delhi
4. Desler, Gary, Human Resource Management, Prentice Hall, latest edition.
5. D'Cenzo, David, A & Stephen P. Robbin, Personnel Human Resource Management, Prentice Hall of India, latest edition.
6. Beardwell, Ian & Len Holden, Human Resource Management, Macmillan, Delhi, latest edition.

Course Code	Course Title		L	T	P	Total
BBBL16F3700	**Business Policy and Strategic Management**	HC	2	1	0	3

Course Objective:

To acquaint the students with the nature, scope and dimensions of business policy and strategy management process.

Course Contents:

Unit – 1

Introduction: Strategic Management, Strategic planning, evolution of strategic management, Strategic Planning and Strategic Management.

Strategic Management Process: Formulation Phase, vision, mission, environmental scanning, objectives and strategy; implementation phase – strategic activities, strategy, evaluation and control and corporate governance.

Unit – 2

Environmental Analysis: Need, Characteristics and categorization of environmental factors, approaches to the environmental scanning process – structural analysis of competitive environment; ETOP a diagnosis tool.

Analysis of Internal Resources: Strengths and Weaknesses; Resource Audit; Strategic Advantage Analysis; Value-Chain Approach to Internal Analysis' Methods of Analysis and diagnosing Corporate Capabilities – Functional Area Profile and Resource Deployment Matrix, Strategic Advantage Profile; SWOT Analysis.

Unit – 3

Formulation of Strategy: Approaches to Strategy formation; Major Strategy Options – Stability, Growth and Expansion, Diversification, Retrenchment, Mixed Strategy; Choice of Strategy – BCG Model; Stop-Light Strategy Model; Directional Policy Matrix (DPM) Model, Product/Market Evolution – Matrix and Profit Impact of Market Strategy (PIMS) Model; Legal Framework for Mergers and Acquisitions.

Unit – 4

Major Issues involved in the implementation of strategy: Organization Structure; Leadership and Resource Allocation.

Implementation, Strategic Evaluation and Control, Operational Controls and Strategic Controls

Text Books:

1. Ghose, P.K -Strategic Planning and Management, Sultan Chand and Sons, New Delhi,
2. Kazmi, Azhar - Business Policy, Tata McGraw Hill, New Delhi
3. Suri, R. K.-Business Policy and Strategic Management, Brijwasi Publisher & Distributor.

Reference Books:

1. Thompson, Arthur A., and Strickland, A.J.- Strategic Management, McGraw Hill, New York
2. Ansoff, H. Igor, Corporate Strategy, Penguin
3. Jauch and Glueck; Business Policy and Strategic Management, McGraw Hill

Course Code	Course Title		L	T	P	Total
BBBL16F3800	**Summer Internship (Evaluation)**	HC	0	0	2	2

Each student shall undergo practical training of eight weeks during the vacations after fourth semester either with a corporate office or a law firm and submit at least two copies of the Summer Training Report to the Dean/Director of the Institution within two weeks of the commencement of the Fifth Semester. It shall be evaluated by a Board of Members consisting of:
(i) Dean/Director of the Institute (ii) two faculty members and an invitee from outside School/Institute.

FOURTH SEMESTER

Course Code	Course Title	L	T	P	Total
BBBL16F4100	**Family Law – I**	3	1	0	4

Course Objective:

To apprise the students with the laws relating to family matters applicable to different communities in India.

Course Contents:

Unit – 1:

1. Joint Hindu Family: Introduction
    a. Mitakshara and Dayabhaga
    b. Formation and Incident under the coparcenary property under Dayabhaga and Mitakshara
    c. Karta of Joint Family: Position, Powers and privileges; Alienation of property by Karta
    d. Debts – Doctrine of pious obligation and antecedent debts

2. Marriage Laws
    a. Hindu Marriage Act, 1955
        i. Evolution of the institution of marriage
        ii. Concept of marriage
        iii. Forms, validity, voidability
    b. Nikah (Muslim Marriage)
        i. Definition, objects and nature
        ii. Essentials and validity

iii. Obligations arising out of marriage – Mahr, Maintenance etc.

c. Laws governing Christian and Parsi marriages

d. Civil Marriages

Unit – 2: Dissolution of Marriage

a. Theories of Divorce

b. Separation and Dissolution of Marriage under Hindu Law

i. Judicial separation

ii. Grounds of Divorce

iii. Divorce by mutual consent

iv. Jurisdiction and procedure

Dissolution of Marriage under Muslim Law

i. By death

ii. By the act of either party

iii. By mutual consent

iv. By court

v. Indian Divorce Act and Parsi Marriage Act

Unit – 3: Adoption and Maintenance

a. Hindu Adoption and Maintenance Act, 1956

b. Adoption

(i) Ceremonies

(ii) Capability

(iii) Effect

c. Maintenance

i. Entitlement

ii. Enforcement

d. Muslim Women (Protection of Rights on Divorce) Act, 1986

- Maintenance under the Code of Criminal Procedure, 1973

Unit – 4: Guardianship

a. Hindu Minority and Guardianship Act, 1956

b. Guardianship – Meaning

c. Kinds of Guardianship

d. Right, obligations and disqualification of guardian

e. Guardianship under Muslim Law

f. Entitlement to guardianship

g. Rights, obligations and disqualification of a guardian

Text books:

1. Hindu Law - Paras Diwan
2. Muslim Law of India - Tahir Mahmood
3. Paras Diwan – Family Laws
4. Principles of Hindu Law–Mulla
5. Principles of Mohammadan Law- Mulla
6. AAA Fayzee- Family Law
7. Dr. Poonam - Family Law, Lexis Nexis
8. Satyajeet Desai - Mulla Hindu Law, Lexis Nexis

Course Code	Course Title		L	T	P	Total
BBBL16F4200	**Constitutional Law – II**	HC	3	1	0	4

Course Objectives:

To orient students with constitutional rights and duties: perspective as well as remedies.

Course Contents:

Unit – 1: Fundamental Rights – I

a. Definition of 'State' for enforcement of fundamental rights – Justifiability of fundamental rights – Doctrine of eclipse, severability, and waiver. Distinction between pre-constitutional law and post-constitutional law
b. Right to equality – Doctrine of Reasonable classification and the principle of absence of arbitrariness
c. Fundamental freedom: Freedom of speech and expression, freedom of association, freedom of movement, freedom to reside and settle, freedom of trade, business and profession – expansion by judicial interpretation – reasonable restrictions

Unit – 2: Fundamental Rights – II

a. Right to life and personal liberty – scope and content – (expensive interpretation)
b. Control over Educational process in India
c. Preventive detention under the Constitution – Policy and safeguards – Judicial review
d. Right against exploitation – Forced labour and child employment
e. Minority Rights

Unit – 3: Right to Constitutional Remedies

1. Right to Constitutional Remedies – Judicial Review – Writs – Habeas Corpus, Mandamus, Certiorari, Prohibition and Quo-warranto – Art 32 and 226

Unit –4: Directive Principles, Fundamental Duties and Social Justice

a. Directive Principles of State Policy – Nature and justiciability of the Directive Principles – Inter-relationship between Fundamental Rights and Directive Principles – Fundamental Duties
b. Social justice under the Indian Constitution – Compensatory discrimination for backward classes – Mandal Commission's case and other cases – Protective discrimination doctrine

Text books:

1. M.P. Jain – Indian Constitutional Law
2. V.N. Shukla – Constitution of India

Reference:

1. D.D. Basu – Constitutional Law of India

Essential Case Law:

1. Electricity Board Rajasthan v. Mohan Lal AIR 1967 SC 185
2. Sukhdev v. Bhagat Roy AIR 1975 SC 1331
3. R.D. Shetty v. International Airport Authority AIR 1979 SC 1628
4. M.C. Mehta v. UOI 1987 (1) SCC 395

5. Mysore Paper Mills v. Mysore Paper Mills Officers Association AIR 2002 SC 609
6. BhikajiNarain v. State of M.P. AIR 1955 SC 781
7. Kailash Chand Sonkar v. Smt. Maya Devi AIR 1984 SC 600
8. Sikkim Subba Associates v. State of Sikkim 2001 (5) SCC 629
9. Olga Tellis v. Bombay Municipal Corp. 1985 (2) SCR 51
10. State of W.B. v. Anwar Ali Sarkar AIR 1952 SC 75
11. Deepak Sibbal v. Punjab University AIR 1989 SC 903
12. Comptroller and Auditor General v. K.V. Mehta 2003 (1) SCALE 351
13. E.P. Royappa v. State of T.N. AIR 1974 SC 555
14. Rattan Lal v. State of Haryana 1985 (4) SCC 43
15. S. Rangarajan v. P. Jagjivan Ram 1989 (2) SCC 574
16. Communist Party of India v. Bharat L. Pasricha AIR 1998 SC 184
17. Union of India v. Motion Pictures 1999 (6) SCC 150
18. Railway Board v. Niranjan Singh 1969 (1) SCC 502
19. Himmat Lal K. Shah v. Commissioner of Police AIR 1973 SC 87
20. OK Ghosh v. Ex. Joseph AIR 1963 SC 812
21. Rupinder v. State AIR 1983 SC 65
22. P.N. Kaushal v. UOI AIR 1978 SC 1456
23. A.K. Gopalan v. State of Madras AIR 1950 SC 27
24. Maneka Gandhi v. Union of India AIR 1978 SC 597
25. HussainaraKhatoon v. State of Bihar AIR 1979 SC 1369
26. M.H. Hoskot v. State of Maharashtra
27. Sunil Batra v. Delhi Administration AIR 1978 SC 1675
28. State of H.P. v. Umed Ram AIR 1986 SC 847
29. Narmada BachaoAndolan v. Union of India 2001 (2) SCC 62
30. N.S. Sahni v. Union of India 2002 (8) SCC 211
31. M.P. Human Rights Commission v. State of M.P.
32. L. Pochanna v. State of Maharashtra AIR 1985 SC 389
33. Fatehchand v. State of Maharashtra AIR 1977 SC 1825
34. Air India Statutory Corporation v. United Labour Union 1997 (9) SCC 377
35. M.R. Balaji v. State of Mysore AIR 1963 SC 648
36. Indira Sawnney v. Union of India AIR 199 SC 477
37. KihotoHollohan v. ZACHILLU AIR 1993 SC 412
38. State of Madras v. Champak DoraiRajan AIR 1951 SC 226
39. MRF Ltd. V. Inspector Kerala AIR 1999 SC 188
40. KeshavnandaBharati v. State of Kerala AIR 1973 SC 1461
41. Minerva Mills v. UOI AIR 1980 SC 1784
42. State of T.N. v. L. Abu Kavvr AIR 1984 SC 326
43. A.I.I.M.S. Students Union v. AIIMS 2002 (1) SCC 428
44. West Bengal Headmasters Association v. Union of India AIR 1987 CAL. 448
45. Javed and Ors. V. State of Haryana 2003 (5) SCALE 602
46. Dasrathi v. State AIR 1985 A.P. 136
47. State of Gujrat v. Hon'ble High Court of Gujarat 1998(7) SCC 392
48. Peoples Union for Democratic Rights v. Union of India AIR 1982 SC 1473
49. University of Mysore v. Govindrao AIR 1965 SC 491
50. B.R. Kapur v. State of T.N. AIR 2001 SC 3435
51. S.I. Syndicate v. UOI AIR 1975 SC 460
52. Union of India v. C. Krishna Reddy 2003 (10) SCALE 1050
53. East India Commercial Co. v. Collector of Customs AIR 1962 SC 1893

54. Syed Yakoob v. K.S. Rashakri AIR 1964 SC 477
55. St. Xavier College Society v. State of Gujrat AIR 1974 SC 1389
56. T.M.A. Pai Foundation v. State of Karnataka AIR 1994 SC 13
57. R.B. Rajbhar v. State of W.B. AIR 1975 SC 623
58. A.K. Roy v. Union of India AIR 1982 SC 710
59. S.R. Bommai v. Union of India 1994 (3) SCC 1
60. ARUNA Roy v. Union of India AIR 2002 SC 3176
61. Javed v. State of Haryana SC AIR 2003
62. M. Ismail Faruqui v. Union of India AIR 1995 SC 605
63. Om Prakash v. DilBahar(2006)
64. MadhavJiwai Rao Scindia v. Union of India
65. Vishaka v. State of Rajasthan
66. M.C.Mehta v. State of Tamil Nadu
67. Parmananda v. Union of India SC AIR 1989
68. Subhash Kumar v. State of Bihar, AIR 1991 SC 420
69. Mohini Jain v. State of Karnataka SC AIR 1982
70. Chameli Singh v. State of U.P SC AIR 1986
71. PUCL v. Union of India SC AIR 1997
72. MurliDeora v. Union of India SC AIR 2002
73. In Re Noise Pollution case SC AIR 2005
74. Ramesh Thapar v. State of Madras SC AIR 1956
75. PrabhuDutt v. Union of India SC AIR 1982
76. LIC V. Manubhai. D.ShahAIR SC 1992
77. Tata Press v. MTNL SCC 1995
78. RanjitUdeshi v. State of Maharashtra SC AIR 1965
79. HamdardDawakhana v. Union of India SC AIR 1960
80. HanifQureshi v. State of Bihar SC AIR 1958
81. AshutoshLahiriv. State of Bihar SC AIR 1995
82. S.P. Gupta v. Union of India (Judges Transfer case) AIR SC 1982
83. S. C. Advocate on Record Association v. Union of India SCC 1993
84. In Re Presidential case 1999
85. L.Chandra Kumar v. Union of India SC AIR 1997
86. Chairman, Railway Board vs. Chandrima Das AIR 2000
87. D.S.Nakara v. Union of India SC AIR 1983
88. SarlaMudgal v. Union of India SC AIR 1995
89. V.V.Giri v. D.S.DoraSC AIR 1959
90. Shah Babo Begum v. Mohammed Ahmad Khan SC AIR 1986
91. Air India v. NargisMeerza SC AIR 1981
92. Randhir Singh v. Union of India SC AIR 1982
93. Yusuf Abdul Aziz v. State of Bombay SC AIR 1954
94. State of A.P v. P.B.Vijaykumar SC AIR 1995

Course Code	Course Title		L	T	P	Total
BBBL16F4300	**Law of Contract - II**	HC	3	1	0	4

Course Objective:
To impart knowledge of various special contract, law of agency and partnership and specific reliefs.

Course Contents:

Unit – 1: Indemnity and Guarantee/Bailment and Pledge

a. Meaning, Distinction between Indemnity and Guarantee
b. Right / Duties of Indemnifier, Indemnified and Surety
c. Discharge of Surety
d. Kinds of Guarantee
e. Bailment and Pledge
f. Meaning and Distinction

Rights and Duties of Bailor / Bailee, Pawnor / Pawnee Lien
Termination of Bailment

Unit – 2: Agency

a. Definitions of Agent and Principal
b. Essentials of relationship of agency
c. Creation of agency: by agreement, ratification and law.
d. Relation of principal / agent, subagent and substituted agent
e. Termination of agency

Unit – 3: Specific Relief Act, 1963

a. Recovery of property
b. Specific performance of contracts
c. Injunctions – Temporary and Perpetual, Mandatory

Unit – 4: The Indian Partnership Act, 1932

a. Nature of partnership firm
b. Relations of partners to one another and outsiders
   Rights /Duties of partners inter se
   Partnership Property
   Relations of Partners to third parties
   Liability for holding out
   Minor as a partner
c. Incoming and outgoing partners
d. Dissolution
   i By consent,
   ii By agreement,
   iii Compulsory dissolution,
   iv Contingent dissolution,
   By notice,
   vi By Court.
   vii Consequences of dissolution
   viii Registration of firms and effects of non-registration

Text Books:

1. Avtar Singh, Law of Contract and Specific Relief
2. Pullock&Mulla, Indian Contract and Specific Relief Acts
3. Avtar Singh - Law of Partnership
4. K. Sukumaran, Pollock & Mulls - The Indian Partnership Act

Course Code	Course Title		L	T	P	Total
BBBL16F4400	**Jurisprudence – I**	HC	3	1	0	4

Course Objective:
To develop an analytical approach to understand the nature of law, development of law and working of a legal system in different dimensions with reference to popular legal theorists.

Course Contents:

Unit – 1: Introduction
a. Nature and scope of Jurisprudence
b. Need for study of Jurisprudence
c. Linkage between Jurisprudence and other sciences

Unit – 2: Schools of Jurisprudence – I
a. Natural Law
b. Analytical positivism, Pure Theory
c. Historical Jurisprudence

Unit – 3: Schools of Jurisprudence – II
a. Sociology Jurisprudence
b. Economic Approach
c. Legal Realism

Unit – 4: Indian Perspectives in Jurisprudence
a. Classical Approach
b. Medieval Influences
c. Modern Trends

Text books:
1. R.W.M. Dias, Jurisprudence
2. Prof. (Mrs.) Nomita Aggarwal , Jurisprudence (Legal Theory)
3. B.N. Maini Tripathi, Legal Theory
4. Edger Bodenheimer, Jurisprudence
5. Salmond on Jurisprudence, 12th Ed. can be added.
6. Lloyd's Introduction to Jurisprudence – International Student Edition

Course Code	Course Title		L	T	P	Total
BBBL16F4500	**Financial Management**	HC	2	1	0	3

Course Objective:
To acquaint the students with the overall framework of financial decision- making in a business Unit

Course Contents:

Unit – 1:

Financial Management: Meaning, Scope, objectives of Financial Management – Profit Vs. Wealth Maximization, Financial Management and other Areas of Management – Liquidity Vs Profitability, Methods of Financial Management, Organization of Finance Function.

Sources of Financing: Classification of Sources of Finance, Security Financing, Loan Financing, Project Financing, Loan Syndication- Book Building, New Financial Institutions and Instruments (in brief) viz. Depositories, Factoring, Venture Capital, Credit Rating, Commercial Paper, Certificate of Deposit, Stock Invest, Global Depository Receipts.

Concept in Valuation: Time Value of Money, Valuation Concepts, Valuation of Securities viz., Debentures, Preference shares and Equity Shares.

Unit - 2:

Concept in Valuation: Time Value of Money, Valuation Concepts, Valuation of Securities viz., Debentures, Preference shares and Equity Shares.

Capital Structure: Meaning, Capital Structure and Financial Structure, Patterns of Capital Structure, Optimum Capital Structure, Capital Structure Theories, Factors Determining Capital Structure, Capital Structure Practices in India.

Cost of Capital: Concept, Importance, Classification and Determination of Cost of Capital.

Leverages: Concept, Types of leverages and their significance.

Unit– 3:

Capital Budgeting: Concept, Importance and Appraisal Methods: Payback period, DCF techniques, Accounting rate of return, Capital Rationing, Concept of Risk, Incorporation of Risk Factor, General Techniques: Risk adjusted discount return, certainty equivalent coefficient and Quantitative Techniques: Sensitivity analysis, Probability assignment, Standard deviation, Coefficient of variation, Decision tree.

Unit- 4:

Working Capital Management: Concept, Management of Cash, Management of Inventories, Management of Accounts Receivable and Accounts Payable, over and under Trading.

Dividend, Bonus and Rights: Dividend Policy, Relevance and Irrelevance Concepts of Dividend, Corporate Dividend Practices in India.

Text Books:

1. Maheshwari S.N. -Financial Management:Principles and Practice, Sultan Chand & Sons, 9th Edition.
2. Khan M.Y, Jain P.K. - Financial Management, Tata McGraw Hill, 3rd Edition.
3. Pandey I. M- Financial Management, Vikas Publishing House, Revised Edition.

References:

1. Hampton, Joh. J - Financial Decision Making, Prentice Hall of India, 4th Edition.
2. Horne Van C. &Wachowich M. -Fundamentals of Financial Management, Prentice Hall of India

Course Code	Course Title		L	T	P	Total
BBBL16F4600	**Corporate Planning and Project Management**	HC	2	1	0	3

Course Objective:
This course focuses on processes to facilitate strategic thinking and trigger strategic initiatives within an Organization. It also emphasis on the students to help organizations initiate (or strengthen their) future-oriented management activities aimed at ensuring sustained performance over time.

Course Contents:

Unit-1
Concept of strategy: a) Defining strategy b) Levels at which strategy operates c) Strategic Decision Making and Approaches to Strategic Decision making d) Mission and Purpose, Objectives and Goals e) Strategic Business Units f) Corporate Planning Process.

Unit-2
Environment Analysis and Diagnosis: a) Concept of Environment and its components b) Environment scanning and appraisal c) organizational appraisal d) Strategic advantage analysis and diagnosis e) SWOT analysis.

Unit-3
Basics of Project Management: Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, Essentials of Project Management Philosophy, Project Management Principles Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Introduction, Project Planning, Need of Project Planning, Project Life Cycle.

Unit-4
Organizational Structure and Organisational Issues: Introduction, Concept of Organizational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Conflict Resolution, Team Management and Diversity Management, Change Management Introduction, Development of Project Network.

Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks.

Course Code	Course Title		L	T	P	Total
BBBL16F4700	**International Business Law**	HC	2	1	0	3

Course Contents:

Unit -1
International Business Law - Nature and Scope-the Ethics of International Business– Globalization: Meaning, Merits, Limitations and irreversibility of Globalization – Need to go global – Internationalization Decisions (entry modes) – SEZ features

Unit –2
Multi National Enterprises (MNEs): Role of MNEs in host economy and Foreign Direct Investment (FDI) – Meaning and Characteristics — Trends in Global FDI – Trends in FDI with

reference to India– Issues with MNEs - Taxation, Restrictive Trade Practices, Currency, Jurisdiction and Technology Transfer

Unit – 3

Foreign Trade Policy and Procedures –Export and Import– Method of Realizing Export Payments and Ensuring Guaranteed Export Payment – Central Excise Clearance Formalities – Customs Regulations and Clearance Formalities for Exports & Imports – Foreign Exchange Risk Management – International Credit Management – Warehousing – Instruments of Trade Policy and India's Trade Policy- Foreign Collaborations and Joint Ventures- kinds – Foreign Direct Investment Policy, Industrial Policy

Unit- 4

International Transporting of Goods- International Trade Finance- Licensing and Electronic Transactions- Dispute Settlement Mechanism (rules and procedures) – IMF, IBRD, ADB**,** International commercial arbitration

Books

1. International Business by K Awasthappa, Mc Graw Hill
2. International Business – Justin Paul, PHI Publications
3. A Guide to Export-Import Consultancy & Registration Services V.K.Pamecha, Paper Bac

Course Code	**Course Title**		L	T	P	**Total**
BBBL16F4800	**Moot Court**	HC	0	0	2	2

SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the V semester)

FIFTH SEMESTER

Course Code	**Course Title**		L	T	P	Total
BBBL16F5100	**Administrative Law**	HC	3	1	0	4

Course Objective:

To make students aware of various aspects of administrative law including quasi-legislative, quasi-judicial and other ministerial functions of administration and control thereof.

Course Contents:

Unit – 1:

Evolution and Scope of Administrative Law

a. Nature, Scope and Development of Administrative Law
b. Rule of law and Administrative Law
c. Separation of powers and its relevance
d. Relationship between Constitutional law and Administrative Law
e. Administrative Law vis-à-vis privatization
f. Classification of functions of Administration

Unit –2:

Legislative Functions of Administration

a. Necessity and Constitutionality

b. Forms and requirements
c. Control
    i. Legislative
    ii. Judicial
    iii. Procedural
d. Sub-delegation

Unit-3:

Judicial Functions of Administration

a. Need for devolution of adjudicatory authority on administration
b. Nature of tribunals – Constitution, powers, procedures, rules of evidence
c. Administrative Tribunals
d. Principles of Natural Justice
    i. Rule against bias
    ii. Audi Alteram Partem
    iii. Reasoned decisions
e. Rules of evidence – no evidence, some evidence and substantial evidence
f. Institutional Decisions

Administrative Discretion and Judicial Control of Administrative Action

A. Administrative Discretion
    a. Need and its relationship with rule of law
    b. Constitutional imperatives and exercise of discretion
    c. Grounds of judicial review
        i. Abuse of discretion
        ii. Failure to exercise discretion
    d. Doctrine of legitimate expectations

B. Judicial Control of Administrative Action
    i. Introduction
    ii. Court as the final authority to determine the legality of administrative action
    iii. Exhaustion of Administrative remedies
    iv. Locus standi
    v. Laches
    vi. Res judicata
    vii. Judicial review and its extent
C. Methods of judicial review
    i. Statutory appeals
    ii. Writs
    iii. Declaratory judgments and injunctions
    iv. Civil Suits for Compensation

Text books:

1. Principles of Administrative Law – M.P. Jain & S.N. Jain
2. Administrative Law – I.P. Massey
3. Administrative Law – Wade
4. Lectures on Administrative Law – C.K.Takwani
5. Administrative Law – S.P. Sathe

Essential Case Law:

1. Ram Jawaya v. State of Punjab (AIR 1955 SC 549)
2. Asif Hameed v. State of J & K (AIR 1989 SC 1899)
3. A.N. Parasoraman v. State of Tamil Nadu AIR 1990 SC 40, (Administrative discretion)
4. State of Punjab v. V.K. Khanna, AIR 2001 SC 343 (Mala fide exercise of power)
5. State of Bombay v. K.P. Krishnan AIR 1960 SC 1322 (irrelevant considerations
6. ShrilekhaVidyarthi v. State of U.P. (AIR 1991 SC 537) (Reasonnablenes)
7. Delhi Laws Act case, AIR 1951 SC 332
8. LachmiNarain v. Union of India AIR 1976 SC 714 (Modification)
9. A.V. Educational Society v. Govt. of A.P. Educational Department (AIR 2002 A.P. 348) (Judicial Control of delegated Legislation)
10. M/s Atlar Cycle Industry Ltd. v. State of Haryana (Legislative Control)
11. Govind Lal Chaggan Lal Patel v. The Agriculture Produce Market Committee (AIR 1976 SC 236) (Procedural Control)
12. Kiran Gupta v. State of U.P. (AIR 2000 SC 3299) (Delegated Legislation)
13. Indian National Congress (1) v. Institute of Social Welfare (AIR 2002 SC 2158) (Classification of Administrative Action)
14. A.K. Kraipak v. Union of India (AIR 1950 SC 150)
15. Hira Nath v. Rajendra Medical College (AIR 1973 SC 1260)
16. Maneka Gandhi v. Union of India (AIR 1978 SC 597)
17. S.N.Mukherjee v. Union of India (AIR 1990 SC1986)
18. Kumaon Mandal Vikas Nigam Ltd. v. Girja Shankar Pant (AIR 2001 SC 24) (Natural Justice, Test of Bias)
19. State of U.P. v. Johrimal (AIR 2004 SC 3800) (Judicial Review) Johri Mal
20. Sayed Yakoob v. Radha Krishan (AIR 1974 SC 477) (Writ Jurisdiction)
21. Shri AnadiMuktaSadguru Trust v. V.R. Rudani (AIR 1989 SC 1607) (Mandamus)
22. R.K. Singh v. Union of India (AIR 2001 Delhi 12) (Mandamus)
23. Kanhaiya Lal Sethia v. Union of India (AIR 1998 SC 365) (Judicial review Cannot be on policy matters)

Course Code	Course Title		L	T	P	Total
BBBL16F5200	**Labour and Industrial Law – I**	HC	3	1	0	4

Course Objective:

To focus on various aspect of management of labour relation and dispute settlement bodies and techniques

Course Contents:

Unit – 1: Introduction to Law of Industrial Disputes Act, 1947:

a. Historical Aspects-Master and slave relationship
b. Industrial revolution
c. Laissez-faire state
d. Impact of Constitution on Labour provision
e. Definition and law relating to Appropriate Government, Award , settlement, Industry, Industrial Dispute, Workman, Strikes and Lock-out

Unit –2: Trade Unions and Collective Bargaining

a. Trade Unionism in India

b. Definition of trade union and trade dispute
c. Registration of trade unions
d. Disqualifications of office-bearers, Right and duties of office-bearers and members
e. General and Political funds of trade union
f. Civil and Criminal Immunities of Registered trade unions
g. Recognition of trade union
h. Collective bargaining

Unit – 3: Standing Orders
a. Concept and nature of standing orders
b. Scope and coverage of the Industrial Employment (Standing Orders) Act, 1946
c. Certification process
d. Modification and temporary application of model Standing Orders
e. Interpretation and enforcement of Standing Orders
f. Penalties and procedure

Unit – 4: Resolution of Industrial Dispute
a. Industrial dispute and individual dispute
b. Strikes
c. Lay off
d. Retrenchment
e. Closure
f. Arena of interaction and Participants– Industry, workman and employer
g. Settlement of industrial dispute
h. Powers of the appropriate Government under the Industrial Disputes Act, 1947
i. Unfair Labour Practice

Statutory Material–
1. Trade Union Act, 1926
2. IndustrialEmployment (Standing Orders) Act, 1946
3. Industrial Dispute Act, 1947

Text books:
1. S.C. Srivastava, Industrial Relations and Labour Law, Vikas Publishing House, New Delhi
2. Industrial Relations and Labour Laws –S.N.Mishra

References:
1. O.P. Malhotra, Industrial Disputes Act, Vol. I & II
2. Indian Law Institute – Cases and Materials on Labour Law and Labour Relations

Course Code	Course Title		L	T	P	Total
BBBL16F5300	**Family Law – II**	HC	3	1	0	4

Course Objective:
To apprise the students with the laws relating to family matters governing succession, partition and religious endowments.

Course Contents:

Unit – 1: Principles of Inheritance

a. The Hindu Succession Act, 1956 General rules of succession of a Hindu male and female dying intestate under the Hindu Succession Act
b. Stridhana and Women's estate
c. Principles of inheritance under Muslim Law (Sunni Law)

Unit – 2: Partition

a. Meaning, Division of right and division of property
b. Persons entitled to demand partition
c. Partition how effected; Suit for partition
d. Re-opening of partition; Re-union
e. Points of similarity and distinction between the Mitakshara and the Dayabhaga Laws

Unit – 3: Religious and Charitable Endowments

a. Endowments
   i. Meaning, kinds and essentials.
   ii. Math – Kinds, Powers and obligations of Mahant and Shefait
   v. Removal and replacement of Idol
b. Waqf
   i. Meaning, Kinds, Rights and Characteristics, Advantages and disadvantages
c. Objects and purpose
   i. Mosques – objects, kind, requisites
   ii. Methods of creation of waqf
d. Pre-emption – Origin, Definition, Classification, Subject matter, formalities, effects, constitutional validity

Text books:

1. Modern Hindu Law – Paras Diwan
2. Outlines of Mohammadan Law – AAA Fyzee
3. Principles of Mahomedan Law –Mulla
4. Mulla Hindu Law- Satyajeet Desai, Lexis Nexis

Course Code	Course Title		L	T	P	Total
BBBL16F5400	**Company Law**	HC	3	1	0	4

Course Contents:

Unit 1: Formation, Registration and Incorporation of Company

Meaning of Corporation
Nature and kinds of company
Promoters: Position, duties and liabilities
Mode and consequences of incorporation
Uses and abuses of the corporate form, lifting of corporate veil
Theory of Corporate personality

Unit 2: Memorandum of Association, alteration and the doctrine of ultra vires
Articles of Association, binding nature, alteration, relation with memorandum of Association, Doctrine of Constructive Notice and Indoor Management-exceptions

Unit 3: Capital Formation of Regulation
Prospectus: Issues, contents, kinds, liabilities for misstatement, statement in lieu of prospectus, The nature and classification of company securities
Shares and general principles of allotment Statutory share certificate, its objects and effects
Transfer of shares, restriction of transfer, relationship between transferor and transferee, issue of share at premium, role of public finance institutions
Share Capital, reduction of share capital Conversion of loans debentures into capital
Duties of court to protect interests of creditors and shareholders

Unit 4: Corporate Administrative
Directors: Kinds, Powers and Duties
Role of nominee Directors, Managing Director and other managerial personnel
The Companies Act, 1956(with Amendment Act 2013)

Books

1. L.C.B.Gower, Principles of Modern Company Law, 1997 Sweet & Maxwell, London
2. A. Ramaiya, Guide to the Companies Act, 1998 Wadhwa
3. Palmer, Palmer's Company Law, 1987 Stevens, London
4. Avtar Singh, Indian Company Law, Eastern Book Co.

Course Code	Course Title		L	T	P	Total
BBBL16F5500	**Public International Law**	**HC**	3	1	0	4

Course Objective:
To acquaint the students with the basics of Public International Law and practice

Course Contents:

Unit – 1: Introduction
a. Nature of International Law
b. Subjects of International Law
c. Relationship between International Law and Municipal Law

Unit –2: Sources of International law
a. Custom
b. Treaties
c. General Assembly Resolutions
d. General Principles
e. Juristic Works
f. Other Sources

Unit-3: Recognition, Extradition and Law of the Sea
a. Recognition

i Theories of Recognition
ii De facto, De jure recognition
iii Implied Recognition
iv Withdrawal of Recognition
v Retroactive Effects of Recognition

b. Extradition
i. State Jurisdiction
ii. Customary Law basis
iii. Treaty Law
iv. The nature of obligation

c. Law of the Sea
i. Territorial Sea
ii. Contiguous Zone
iii. Exclusive Economic Zone
iv. Continental Shelf
v. High Sea

Unit – 4: International Organizations
a. UN
b. ICJ
c. IMF and IBRD
d. WTO
e. ICAO
f. IAEA
g. UNEP

Text books:
1. Starke – Introduction to International Law
2. Oppenheim - International Law
3. Brownlie – Principles of International Law
4. S.K. Kapoor- Public International Law

References:
1. Shaw - International Law

Course Code	Course Title		L	T	P	Total
BBBL16F5600	**Jurisprudence-II**	HC	3	1	0	4

Course Contents:

Unit-1: State, Sovereignty and Law
a. Nature and functions of a State and its relationship with law
b. Nature and development of Sovereignty
c. Nature and kinds of law and theories of justice

Unit-2: Sources of Law
a. Custom
b. Precedent

c. Legislation
(Emphasis on Indian perspective)

Unit – 3: Concepts of Law

a. Rights and Duties
b. Personality
c. Possession, Ownership and Property

Unit-4: Principles of Liability

a. Liability and Negligence
b. Absolute Liability
c. Immunity

Text books:

1. Salmond's Jurisprudence
2. R.W.D. Dias, Jurisprudence
3. Prof.(Mrs.) Nomita Aggarwal, Jurisprudence (Legal Theory)
4. Rama Jois - Seeds of Modern Public Law in Ancient Indian Jurisprudence

Course Code	Course Title		L	T	P	Total
BBBL16F5700	Summer Internship (Evaluation)	HC	0	0	2	2

* Marks allocation for the report submission of summer training undertaken at the end of Fourth Semester with a corporate lawyer or Law Firm.

Course Code	**Course Title**		L	T	P	**Total**
BBBL15F5800	**Moot Court**	HC	0	0	2	**2**

SIXTH SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F6100	**Law of Crimes-II Criminal Procedure Code**	HC	3	1	0	4

Course Objective:

Course Contents:

Unit 1:

Nature and scope of Criminal Procedure- Preliminary Considerations: Classification of offences, hierarchy of Criminal Courts, Functionaries under the Code -the Organisation of the Police, Prosecutor and Defense Counsel- Cognizable and non-cognizable offences

Unit 2:

Arrest: definition and types of arrest- Rights of arrested persons under Cr. P.C. and Article 22 (2) of the Constitution of India – Search and Seizure- Charge-charge, maintenance of public

order and tranquility- F.I.R and Investigation, charge sheet -Warrant and Summons.

Unit 3:

Trials: Various kinds of trials, concept of fair trials, hearing the accused, Judgement, Trial procedure in Criminal Cases- Plea bargaining procedure, General Provisions as to Inquiries and Trials, provisions relating as to accused person of unsound mind, Provisions relating to judgement, Submission of Death Sentence for confirmation.

Unit 4:

Appeal – kinds of Appeal, when appeal is not permissible, Appeal in non-appealable cases, Powers of the Appellate Court. Reference, Revision and Transfer of cases: functions and significance- Execution, Suspension, Remission and Commutation of sentences. Bail: bailable and non- bailable offences and related provisions, Anticipatory Bail and Miscellaneous- inherent powers of High Court.

Text Books:

1. Ratanlal & Dhiraj Lal- The Code of Criminal Procedure
2. R.V. Kelkar- Criminal Procedure
3. K. N. Chandrasekharan Pillai- Criminal Law

Reference Books:

1. H.S. Gaur – Penal Law of India
2. Report of the Committee on Reforms of Criminal Justice System

Essential Case Law:

1. Govinda's Case – (1876), Bom 342
2. State of A.P. v. R. Punnayya – 1977 Cr LJ 1(SC)
3. K.M. Nanavati v. State of Maharashtra – 1962 (Bom) LR 488 (SC) - AIR 1962 SC 605
4. Bachan Singh v. State of Punjab (1980) 2 SCC 684
5. Joginder Singh v. State of U.P.,(1994) 4 SCC 260
6. NandiniSatpathy v. P.L.Dani(1978) 2 SCC 424
7. Balchand Jain v. State of M.P.,(1976)4 SCC 572
8. Shashi Nayar v. Union of India – 992 Cr LJ 514
9. Virsa Singh v. State of Punjab – AIR 1958 SC 465
10. Om Prakash v. DilBahar (2006)
11. The Nirbhaya Case (2012)
12. Harjinder Singh v. Delhi Administration – AIR 1968 SC 867
13. Mahesh Balmiki v. State of M.P. – 2000 (1) SCC 319
14. Tukaram v. State of Maharashtra – AIR 1979 SC 185
15. State of Punjab v. Gurmit Singh – AIR 1996 SC 1393
16. Bodhisattwa Gautam v. Miss SubhraChakrabarty – AIR 1996 SC 922
17. BiswanathMallick v. State of Orissa – 1995 Cr LJ 1416 (ori)
18. State of Madras v. Vardarajan – AIR 1965 SC 942
19. State of Haryana v. Raja Ram – AIR 1973 SC 819
20. Vishwanath v. State of U.P. – AIR 1960 SC 67
21. State of HP v. Nikku Ram – 1995 Cri LJ 4184 (SC)
22. P. Rathinam v. Union of India – AIR 1994 SC 1844
23. Gian Kaur v. State of Punjab – AIR 1996 SC 946
24. State v. Lekhraj – 2000 (1) SCC 247

25. SikharBehera v. State of Orissa – 1993 Cr LJ 3664
26. Dhananjai v. State of U.P. – AIR 1996 SC 556
27. Shanti v. State of Haryana
28. State of Kerala v. Mathai Verghese – (1986) 4 SCC 746

Course Code	Course Title		L	T	P	Total
BBBL16F6200	**Environmental Studies and Environmental Law**	HC	3	0	1	4

Course Objective:
To acquaint the students with the environmental issues andthe measures taken for its protection along with the norms prevailing at international and national level

Course Contents:

Unit– 1: Introduction to Environmental Law:
a. National and International perspective
   i. Environmental (Protection) Act, 1986
   ii. Environment – Meaning
   iii. Environment Pollution – Meaning and Issues
b. International Norms
   i. Sustainable Development – Meaning and Scope
   ii. Precautionary Principle
   iii. Polluter pays Principle
   iv. Public Trust Doctrine

Unit –2: Constitutional Guidelines and Legislations
a. Right to Wholesome Environment – Evolution and Application
   i. Relevant Provisions – Art. 14, 19 (1) (g), 21, 48-A, 51-A(g)
   ii. Environment Protection through Public Interest Litigation
b. Other Laws
   i. Law of Torts
   ii. Law of Crimes
c. Prevention and Control of Water and Air Pollution
   i. The Water (Prevention and Control of Pollution) Act, 1974
   ii. Air (Prevention and Control of Pollution) Act, 1981

Unit – 3: Protection of Forests and Wild Life
a. Indian Forest Act, 1927
   i. Kinds of forest – Private, Reserved, Protected and Village Forests
   ii. The Forest (Conservation) Act, 1980
b. The Wild Life (Protection) Act, 1972
   i. Authorities to be appointed and constituted under the Act
   ii. Hunting of Wild Animals
   iii. Protection of Specified Plants
   iv. Protected Area
   v. Trade or Commerce in wild animals, animal articles and trophies; Its prohibition.

Unit–4: Principle of 'No fault' and 'Absolute Liability'

i. Public Liability Insurance Act, 1991
ii. The National Environment Tribunal Act, 1995

Text Books

1. Environmental Law & Policy in India – ShyamDiwan, Armin Rosencranz
2. Environmental Law in India – P. Leelakrishnan

Statutes:

1. The Water (Prevention and Control of Pollution) Act, 1974
2. The Air (Prevention and Control of Pollution) Act, 1981
3. The Indian Forest Act, 1927
4. The Forest (Conservation) Act, 1980
5. The Wild Life Protection Act, 1972
6. The Environment (Protection) Act, 1986
7. The Public Liability Insurance Act, 1991
8. The National Environment Tribunal Act, 1995
9. The National Environment Appellate Authority Act, 1997

References:

1. Environmental Law in India – Gurdip Singh
2. Environmental Administration, Law and Judicial Attitude – Paras Diwan, Peeyushi Diwan
3. Dr. Choudhary - Environmental Ethics

Essential Case Law:

1. Subhash Kumar v. State of Bihar, AIR 1991 SC 420
2. M.C. Mehta v. Union of India, AIR 1997 SC 734
3. M.C. Mehta v. Kamal Nath, AIR 2000 SC 1997
4. M/s Abhilash Textiles v. Rajkot Municipal Corporation. AIR 1988 Guj. 57
5. Indian Council for Enviro-Legal Action v. Union of India, AIR 1996 SC 1446
6. Vellore Citizen Welfare Forum v. Union of India, AIR 1996 SC 2715
7. A.P. Pollution Control Board v. M.V. Nayudu, AIR 1999 SC 812
8. Narmada BachaoAndolen v. Union of India, AIR 2000 SC 3751
9. M/S. Delhi Bottling Co. Pvt. Ltd. v. Central Board for the Prevention and Control of Water Pollution, AIR 1986 Del. 152
10. Tata Tea Ltd. v. State of Kerala, 1984 K.L.T. 645
11. M.C. Mehta v. Union of India, 1998 (4) SCALE 196
12. Orissa State Pollution Control Board v. M/s. Orient paper Mills, AIR 2003 SC 1966
13. Tarun Bharat Singh v. Union of India (1994) 2 SCALE 68
14. T.N. GodavarmanThirumulkpad v. Union of India, AIR 1998 SC 769
15. Vellore Citizens Welfare Forum v. Union of India, AIR 1996 SC 2715
16. S. Jagannath v. Union of India, AIR 1997 SC 811
17. M.C. Mehta v. Union of India, (Relocation of Industries in Delhi), AIR 1996 SC 2231
18. A.P. Pollution Control Board v. M.V. Nayudu, AIR 1999 SC 812

Course Code	Course Title		L	T	P	Total
BBBL16F6300	**Civil Procedure Code and Limitation Act**	HC	3	1	0	4

Course Objective:

To help a law student to acquire a thorough knowledge of procedural aspects of working of civil courts and other machineries

Course Contents:

Unit – 1:
Introduction of Limitation Act:

a. Meaning, Nature, Scope, Bar of Limitation
b. Sufficient Cause, Legal Disability
c. Latches, Acquiescence, Prescription
d. Extension and suspension of Limitation
e. Liability of the Government

Introduction to Civil Procedure Code:

a. Definitions: Decree, Judgement, Order, Foreign Court, Foreign Judgement, Mesne, Profits, Affidavit, Suit, Plaint, Written Statement
b. Important Concepts: Res Sub-Judice, Resjudicata, Restitution, Caveat, Inherent powers of courts

Unit – 2: Initial steps in a suit

a. Jurisdiction and place of suing
b. Institution of suit
c. Pleadings: Meaning, object, General rules, Amendment of pleadings
d. Plaint and written statement
e. Discovery, Inspection and production of documents
f. Appearance and non-appearance of parties
g. First hearing

Unit – 3: Interim Orders

a. Commissions
b. Arrest before judgement
c. Attachment before judgement
d. Temporary Injunctions
e. Interlocutory orders
f. Receiver
g. Security of costs

Unit – 4: Suits in Particular Cases and Limitation Act

a. Suits by or against Government
b. Suits by Indigent persons
c. Interpleaded Suit
d. Summary Procedure
e. Suits relating to public nuisance

The Limitation Act 1963

Text books:

1. Code of Civil Procedure, 1908 (Relevant Provisions)
2. C.K. Takwani- Code of Civil Procedure
3. Mulla – Code of Civil Procedure
4. Sarkar's Code of Civil Procedure

References:

1. Ganguly – Civil Court, Practice and Procedure
2. M.P. Tandon – Code of Civil Procedure

Essential Case Law:

1. Topandas V/s Gorakhram, AIR 1964 SC 1348
2. Dhulabhai V/s State of H.P., AIR 1969 SC 78
3. Premier Automobile V/s Kamlakar, 1976 (1) SCC 496
4. Rajasthan State Road Transport Corpn. V/s Krishna Kant – 1995 (5) SCC 75
5. Pandurang V/s Shantibai, AIR 1989 SC 2240
6. Workmen C.P. Trust V/s Board of Trustee, 1978 (3) SCC 119
7. Razia Begum V/s Anwar Begum, AIR 1958 SC 886 (895)
8. B.K.N. Pillai V/s P. Pillas, AIR 2000 SC 614
9. Sangram Singh V/s Election Tribunal, AIR 1955 SC 425
10. Martin Burn Ltd. V/s Banerjee, AIR 1958 SC 79
11. Dalpat V/s Prahlad,. 1992 (1) SCC 719
12. Gujrat Battling Co. Ltd. Coca Cola Co., 1995 (5) SCC 545
13. Morgan Stanly V/s Kartick Das, 1994 (4) SCC 225
14. Bihari Chowdhary V/s State of Bihar, 1984 (2) SCC 627
15. Raj Duggal V/s Ramesh Kumar, AIR 19f90 SC 2218

Course Code	**Course Title**		L	T	P	Total
BBBL16F6400	**Investment and Competition Law**	HC	3	1	0	4

Course Objective:

To focus on the investment and competition laws of India in the contest of new economic order

Course Contents:

Unit – 1: Competition Law

a. Background
b. Prohibitions
c. Competition Commission of India

Unit-2: Corporate Finance and regulatory framework

a. Security Contract (Regulation) Act 1956
b. SEBI Act 1992
c. Depositories Act 1996
d. The Securitization and Reconstruction of Financial Assets and enforcement of security Interest Act, 2002

Unit-3: Regulatory framework for foreign trade, multinational companies,

a. Foreign Trade (Development & Regulation) Act 1992,
b. UNCTAD Draft Model on Trans – national Corporations
c. Control and regulation of foreign companies in India,
d. Foreign collaborations and joint ventures

Unit – 4: Foreign Exchange Management

a. Background
b. Policies
c. Authorities

Text Books:

1. Competition law –Avtar Singh
2. Competition Law –S. C. Tripathi
3. Competition and Investment Laws In India –Singhal Law Publications
4. Versha Vahini - Indian Competition Law

Statutes:

1. Competition Act 2002
2. Security Contract (Regulation) Act 1956
3. SEBI Act 1992
4. Depositories Act 1996
5. Foreign Trade (Development & Regulation) Act 1992,
6. Foreign Exchange Management Act, 1999

Reference:

1. Taxman's Student's Guide to Economic Laws
2. Principles of International Investment law –Rudolf Dolzer Christoph Schreuer

Course Code	Course Title		L	T	P	Total
BBBL16F6500	**Labour and Industrial Law – II**	HC	3	1	0	4

Course Objective:

To focus on wage policies, compensation for learn caused during the course of employment and working conditions of employees

Course Contents:

Unit – 1: Minimum Wages Act, 1948

a. Concept of minimum wage, fair wage, living wage and need based minimum wage
a. Constitutional validity of the Minimum wages Act, 1948
b. Procedure for fixation and revision of minimum wages
c. Fixation of minimum rates of wage by time rate or by piece rate
d. Procedure for hearing and deciding claims

Unit-2: Payment of Wages Act, 1936

a. Object, scope and application of the Act
b. Definition of wage

c. Responsibility for payment of wages
d. Fixation of wage period
e. Time of payment of wage
f. Deductions which may be made from wages
g. Maximum amount of deduction

Unit –3: Workmen's Compensation Act, 1923
a. Definition of dependant, workman, partial disablement and total disablement
b. Employer's liability for compensation
   - Scope of arising out of and in the course of employment
   - Doctrine of notional extension
   - When employer is not liable
c. Employer's Liability when contract or is engaged
d. Amount of compensation
e. Distribution of Compensation
f. Procedure in proceedings before Commissioner
g. Appeals

Unit – 4: Factories Act, 1948
a. Concept of "factory", "manufacturing process" "worker" and "occupier"
b. General duties of occupier
c. Measures to be taken in factories for health, safety and welfare of workers
d. Working hours of adults
e. Employment of young person and children
f. Annual leave with wages
g. Additional provisions regulating employment of women in factory

Text books:
1. S.C. Srivastava, Commentaries on factories Act, 1948, Universal Law Publishing House, Delhi
2. H.L. Kumar, Workmen's Compensation Act, 1923

Course Code	**Course Title**		L	T	P	Total
BBBL16F6610	**Human Rights Law**	SC	2	1	0	3

Course Objective:
To lay among students the foundation of the Human Rights law and acquaint them with basic human rights institutions

Unit – 1: Introduction
a. History
b. Evolution
c. Growth

Unit – 2: UN Charter and Human Rights
a. UDHR
b. Covenants of 1966
c. Optional Protocols

Unit – 3: Human Rights under the Indian Constitution and their Enforcement

a. Fundamental Rights
b. Directive Principles of State Policy

Unit – 4: Role of Judiciary and Group Rights

a. NHRC
b. NGOs

Group Rights

a. Prisoners
b. Women and Children
c. Indigenous People
d. Disabled

Statutes & Conventions:

1. Human Rights Act, 1993
2. United Nations Charter

Text books:

1. Sinha, M.K. – Implementation of Non-Derogation Human Rights
2. Rashee Jain- Textbook on Human Rights Law & Practice

References:

1. D.D. Basu – Human Rights
2. UpendraBaxi – The Future of Human Rights
3. Thomas Buergenthal – Human Rights
4. Henry Steiner & Philip Alston – International Human Rights Law
5. B.G. Ramcharan – International Human Rights (Oxford)
6. Y.K. Tyagi – British Yearbook

Course Code	**Course Title**		L	T	P	Total
BBBL16F6620	**Cyber Law**	SC	2	1	0	3

Course Objective:

The aims and objectives of the study of Cyber Law are to promote legal knowledge and the growth of jurisprudence of Cyber law. To develop legal expertise in order to match the emerging contemporary challenges in the area of cyber space

Course Contents:

Unit 1:

Fundamentals of Cyber Space
Understanding Cyber Space
Interface of Technology and Law Defining Cyber Laws

Unit 2:

Jurisdiction in Cyber Space

Concept of Jurisdiction
Internet Jurisdiction
Indian Context of Jurisdiction
International position of Internet Jurisdiction Cases in Cyber Jurisdiction

Unit 3:

E-commerce- Legal issues
Legal Issues in Cyber Contracts
Cyber Contract and IT Act 2000
The UNCITRAL Model law on Electronic Commerce

Unit 4:

Intellectual Property Issues and Cyberspace – The Indian Perspective
Overview of Intellectual Property related Legislation in India
Copyright law & Cyberspace
Trademark law & Cyberspace
Law relating to Semiconductor Layout & Design

Books:

1. N.C.Jain- Cyber Law
2. Justice Yatindra Singh- Cyber Laws
3. Pavan Duggal - Textbook on Cyber Law
4. Dr. Jyoti Rattan & Vijay Rattan -CYBER LAWS & Information Technology
5. Rodney D. Ryder - Guide to Cyber Laws (Information Technology Act, 2000, E-Commerce, Data Protection & the Internet).

Course Code	**Course Title**		L	T	P	**Total**
BBBL16F6700	**Moot Court**	HC	0	0	2	2

SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the VII semester)

SEVENTH SEMESTER

Course Code	**Course Title**		L	T	P	Total
BBBL16F7100	Law of Evidence	HC	3	1	0	4

Course Objective:

The students shall be acquainted with the rules of Evidence in trials as well as the relevancy of facts, proofs and production of Evidence.

Course Contents :

Unit – 1: Introduction and Relevancy

a. Evidence and its relationship with the substantive and procedural laws
b. Definitions – Facts, facts in issue, relevant, evidence proved, disproved, not proved, oral and documentary evidence
c. Relevancy and admissibility

d. Doctrine of res gestae
e. Conspiracy

Unit – 2: Statement – Admissions / Confessions and Dying Declarations
a. Admissions
b. Confessions
c. Dying Declarations

Unit – 3: Method of proof of facts
a. Presumptions
b. Expert opinion
c. Character
d. Oral and documentary evidence
e. Rules relating to Burden of proof
f. Estoppel
g. Privileged Communications

Unit – 4: Presumptions regarding discharge of burden of proof
a. Evidence by accomplice
b. Judicial notice
c. Dowry Death
d. Certain Offences

Text books:
1. Rattan Lal Dheeraj Lal – The Law of Evidence
2. Avtar Singh – Principles of the Law of Evidence
3. M. Monir – The Law of Evidence
4. Woodroffe & Syed Amir Ali's Law of Evidence

Course Code	**Course Title**		L	T	P	Total
BBBL16F7200	**Property Law**	HC	3	1	0	4

Course Objective:
To focus on concept and classification of property aswell as principles governing transfer of immoveable property

Course Contents:

Unit-1:
Concept of Property and General Principles Relating to Transfer of Property
a. Concept of property – distinction between movable and immovable property
b. Transferability of property
c. Compartment transfer
d. Conditions restricting transfer
e. Definition of transfer of property
f. Transfer and non-transfer property
g. Transfer to an unborn person and rule against perpetuity

h. Vested and Contingent interest
i. Rule of Election

Unit-2:
General Principles Governing Transfer of Immoveable Property
a. Transfer by ostensible owner
b. Rule of feeding grant by estoppel
c. Rule of Lis pendens
d. Fraudulent transfer
e. Rule of part performance

Unit – 3: Specific Transfers – I
a. Sale and gift
b. Mortgage and charge

Unit – 4: Specific Transfer – II
b. Acquisition
c. Lease and License
d. Easements

Text books:
1. Mulla D.F. – Transfer of property
2. H.N. Tiwari – Transfer of property Act
3. Dr. G.P.Tripathi - The Transfer of Property Act
4. Dr. Poonam Pradhan S.-Property Law

Course Code	Course Title		L	T	P	Total
BBBL16F7300	**Professional Ethics and Professional Accounting System**	HC	3	1	0	4

Course Contents:

Unit 1
Historical development of Legal Profession in India
Bar Council of India
Admission and enrolment of Advocates

Unit 2
Profession ethics and Advocacy, Standards of Professional Conduct and Etiquette, Conflict between interest and duty, Duty To court, Duty to Client, Duty to opponent, Duty to Colleagues, Duty towards Society and obligation to render legal aid

Unit 3
Bench-Bar Relationship
Reciprocity as partners in administration of Justice
Professional Misconduct
Rights and Privileges of Advocates

Unit 4

Contempt of Court Act, 1971

Historical development of Contempt of Court Act in India, Object and Constitutional validity of Contempt of Court Act, Definition, Kinds of Contempt, Contempt by Judges, Magistrates, Lawyers and other persons, Cognizance, Procedure, Appellate provisions regarding Contempt Defenses, Punishment and Remedies against punishment for Contempt of Court and Punishment for Contempt, Defenses under contempt of court

Accountancy for lawyers: Maintenance of account books, aspects of book keeping and cash book.

Cases:

1. Rajendra V Pai v Alex Fernandes AIR 2002 SC 1808
2. In re; A an advocate AIR 1962 SC 1337
3. In re; Mr. G a Senior Advocate of SC AIR 1954 SC 557
4. In re; Lalit Mohan Das AIR 1957 SC 250
5. Sheo Narayan Jafa v Judge Allahabad H.C. AIR 1953 SC 368
6. P. J. Ratnam v d. Kanik ran AIR 1964 SC 244
7. In re; "M" an Advocate AIR 1957 SC 149
8. L.D. Jaisingham v Narain das N Punjabi (1976) 1 ACC 354
9. Jhon D' Souza v Edward Ani (1994) 2 SCC 64
10. In re; V.C. Mishra AIR 1995 SC 2348

Acts

1. The Indian Advocate Act, 1961
2. Contempt of Court Act, 1971
3. The Advocates Welfare Fund Act, 2001

Rule

The Bar Council of India Rules, 1961

Books

1. Holland Avrom Shree, Advocacy, 1994 Universal, Delhi
2. Keith Evam,The Golden Rules of Advocacy, 1994, Universal, Delhi
3. Sandeep Bhalla, Advocates Act & Professional Misconduct, Nasik Law House
4. JPS Sirohi, Professional Ethics, Lawyer's Accountability, Bench-Bar Relationship, ALA
5. Mr. Krishna Murthy Iyer's Book on Advocacy
6. The Bar Council Code of Ethicsselected opinions of the Disciplinary Committees of Bar Councils
7. Lamps of Advocacy –Judge Edward Abbot Parry

Course Code	Course Title		L	T	P	Total
BBBL16F7400	**Client Interviewing Counseling & Advocacy Skills**	HC	3	1	0	4

References:

A Practical Approach to Client Interviewing, Counseling, and Decision-Making: For Clinical Programs and Practical Skills Courses (2009)
Publisher: LexisNexis

G. Nicholas Herman, Adjunct Professor, North Carolina Central University School of Law Jean M. Cary, Professor of Law, Campbell University, Norman Adrian Wiggins School of Law

Course Code	Course Title		L	T	P	Total
BBBL16F7500	**Principles of Taxation (Direct Tax)**	HC	3	1	0	4

Course Objective: The course content has been designed to provide a comprehensive understanding of the laws pertaining to taxation in India.

Course Contents:

Unit 1:

History of Tax Law in India, Constitutional provisions relating to Taxation Nature and Scope of Tax, Definition: Persons, Assesses, Tax Pays, Previous year, Assessment years, Financial year, Income, Gross Taxable Income, Taxable Income, Agricultural Income, Tax Evasion and Tax Avoidance

Unit 2: Direct Tax

Income Tax, Residential Status: Rules (Sec.6), Tax Liability
Exemption (Sec.10), Deduction (Sec.80), related to individual, Expenses & Income, Rebate (Sec.88 & 88 B), Deemed income and clubbing of income, Carried Forward and Set of losses.

Unit 3: Income Tax

Heads of Income: Income from Salary, House property, Business and Profession, Capital Gain and other sources
Calculation of Gross Total and Taxable income, Tax rebate and Computation of Tax Liability, Tax Collection at source and Advance Tax

Unit 4

Assessment Procedure, Types of Assessment
Income Tax Authority: Their function, Duties and Powers, Appeal, Offences, Fines and Penalties, Settlement of grievances and Prosecution, Income Tax Act, 1961, Income Tax Rules

Books:

1. Ramesh Sharma, Supreme Court on Direct Taxes
2. Sampat Iyengar, Law of Income Tax
3. Kanga and Palkiwala, The Law and Practice of Income Tax
4. T. N. Manoharan - Direct Tax Laws

Course Code	Course Title		L	T	P	Total
BBBL16F7600	**Open Elective**	**OE**	3	0	1	4

Course Objective:
The objective of the course is designed to convince the students how the right to information is a potent weapon to bring in transparency and accountability in governance as well as preventing the abuse of power

Course Contents:

UNIT 1 - A General Overview/ Public Authorities and their Obligations
The evolution of the Right to Information in India, The philosophy underlying the Right to Information Act, 2005 and the paradigm shift it envisages, the important terms and concepts used in the Act, The salient features of the Act.

Public Authority; Public Authorities covered under the Act; Public Authorities are exempted from the ambit of the Act; Obligations of Public Authorities.

UNIT 2 - Role of Public Information Officers: PIOs and APIOs / Exemptions from Disclosure of Information, Partial Disclosure and "Third Party" Information
Accepting an Information Request, Processing and Disposing; The requirement for designation of Information Officers - PIOs / APIOs - in public authorities; the specific Duties & Responsibilities of Information Officers; The liabilities of a PIO for non-compliance with the provisions of the Act.Disposal of requests;The time limits for disposal of information requests; The fees and costs to be charged for providing information; The grounds on which requests can be rejected and the procedure for such rejection.

Specific provisions of the Act which exempt certain kinds of information - the classification of such exempted information; Application of public interest test with respect to exempted information; Grounds that allow for partial disclosure of information; The concept of 'Third Party' and the issues and considerations revolving around its involvement.

UNIT 3 - APPELLATE OFFICERS WITHIN PUBLIC AUTHORITIES AND INFORMATION COMMISSION
The process involved in making first appeals to designated Appellate Officers; Timelines for making a first appeal and disposal of the appeal; First Appeals and Appellate Officers - Important Provisions. The Role and Responsibilities of the Information Commissions; The relevant provisions in the RTI Act dealing with Complaints to the Information Commission and the specifications; The "Second Appeal" process and the Commissions'; The power of Information Commissions.

UNIT 4 - RTI AND GOOD GOVERNANCE
Role of Civil Society Organizations and Media; Records Management for Effective Information Management and Implementation of the Act; The importance of records management; The broad issues relating to the keeping, maintaining, managing and destructing.

Books
1. Rodney Ryder- RIGHT to INFORMATION - Law, Policy & Practice
2. V.K.Puri, for JBA Publishers - RIGHT to INFORMATION - Law, Practice & Procedure (Commentary)
3. Dr.Kunwar Vijay Pratap Singh, IPS -Right to Information - Law &Practice

4. Dr. A K S Massey - Law relating to Right to Information
5. N. V. Paranjape - Right toInformation Law in India

Course Code	Course Title		L	T	P	Total
BBBL16F7700	**Summer Internship (Evaluation)***	HC	0	0	2	2

Course Code	Course Title		L	T	P	Total
BBBL16F7800	**Moot Court**	HC	0	0	2	2

EIGHT SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F8100	**Drafting Pleading and Conveyance**	HC	3	1	0	4

Course Objective:
To train students in the art of drafting both for court purposes as well as for other legal forums.

Course Contents:

Unit – 1:
Professional ethics and Advocacy and Fundamental Rules of Pleadings
Standards of Professional; Conduct and Etiquette, Conflict between interest and duty; Bench-Bar Relationship; Contempt of Court Act, 1971;

a. Plaint Structure
b. Description of Parties
c. Written Statement and affidavit
d. Application for setting aside ex-part decree

Unit – 2: Ordinary suit for Recovery

a. Suit under Order XXXVII of CPC and the difference between the two suits
b. Suit for Permanent Injunction
c. Application for temporary injunction Order XXXIX of CPC
d. Suit for Specific Performance
e. Petition for eviction under the Delhi Rent Control Act

Unit – 3: General Principles of Criminal Pleadings

a. Application for bail
b. Application under Section 125 Cr.P.C.
c. F.I.R. – under Section 154 Cr.P.C.

Unit – 4: Model Draft

Forms

i. Notice to the tenant under section 106 of Transfer of Property Act
ii. Notice under section 80 of CPC
iii. Reply to notice
iv. General Power of Attorney
v. Will
vi. Agreement to Sell
vii. Sale – deed
viii. Suit for Dissolution of Partnership
ix. Petition for grant of probate / Letters of Administration
x. Application for appointment of receiver/Local Commissioner
xi. Application for Compromise of Suit
xii. Application for Appointment of Guardian
xiii. Application to sue as an indigent person under Order 33 CPC
xiv. Appeal from original decree under Order 41 of CPC
xv. Appeal from orders under order 43 of CPC
xvi. Revision Petition
xvii. Review Petition
xviii. Application under section 5 of Limitation Act
xix. Application for execution
(Application for caveat section 148A of CPC
xx. Writ Petition
xxi. Application under section 482 of CPC
xxii. Compounding of offences by way of compromise under section 320(i) Cr.P.C.
xxiii. Lease deed
xxiv. Special Power of Attorney
xxv. Relinquishment Deed
xxvi. Partnership Deed
xxvii. Mortgage Deed
xxviii. Reference to Arbitration and Deed of Arbitration
xxix. Deed of gift
xxx. Notice under section 434 of the Companies Act Notice for Specific Performance of Contract

Text books:

1. Bindra N.S. : Conveyancing, Draftsman & Interpretation of Deeds
2. Pleadings Drafting & Conveyancing by Rn Chaturvedi
3. Mogha's Law of Pleading in India with Precedents
4. De Souza's Forms and Precedents of Conveyancing book

Course Code	**Course Title**		L	T	P	Total
BBBL16F8200	**Intellectual Property Law**	**HC**	3	1	0	4

Course Objective:

To acquaint the students with basics of intellectual property rights with special reference to Indian law and practice

Course Contents

Unit – 1: Introduction:

a. Concept of Property
b. Industrial Property and Non Industrial Property
c. Historical background of IPR
d. International Conventions and Treaties: Paris Convention and Madrid Convention
e. WIPO: Background and Features

Unit –2: Copyright and Patents

a. Nature and Meaning
b. Scope of protection
c. Procedure for protection
d. Enforcement and Remedies

Unit –3: Trademarks

a. Nature and Meaning
b. Scope of protection
c. Procedure for protection
d. Enforcement and Remedies

Unit –4: Designs and Geographical Indications

a. Nature and Meaning
b. Scope of protection
c. Procedure for protection
d. Enforcement and Remedies

Text Books:

1. P. Narayanan – Intellectual Property Law.
2. Cornish William – Intellectual Property.

Statutes & Conventions:

1. Paris Convention for the Protection of Industrial Property, 1883;
2. Berne Convention for the Protection of Literary and Artistic Works, 1886;
3. Indian Copyright Act, 1957;
4. Indian Patents Act, 1970;
5. Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994 (the TRIPS Agreement);
6. Indian Trademarks Act, 1999;
7. Indian Designs Act, 2000.

References:

1. Cornish, W. R., Intellectual Property (London: Sweet & Maxwell, 1996);
2. Correa, Carlos M., Intellectual Property Rights, the WTO and Developing Countries: The TRIPS Agreement and Policy Options (Penang: Third World Network, 2000);
3. Pratap, Ravindra, India at the WTO Dispute Settlement System (New Delhi: Manak, 2004), Chapters 4 and 5.
4. Adelman, Martin J. and Baldia, Sonia, "Prospect and Limits of the Provision in the TRIPS Agreement: The Case of India", Vanderbilt Journal of Transnational Law, vol. 29, no. 3 (1996), 507.

5. Beier, Friedrich-Karl and Schricker, Gerhard, eds., From GATT to TRIPS—The Agreement on Trade-Related Aspects of Intellectual Property Rights (Weinheim: VCH, 1996).
6. Bronkers, Marco C. E. J., "The Impact of TRIPS: Intellectual Property Protection in Developing Countries", Common Market Law Review, vol. 31, (1994), 1245.
7. C. Wadlow, Enforcement of Intellectual Property in European and International Law (London: Sweet & Maxwell), 1998).
8. Canada – Patent Protection of Pharmaceutical Products, Report of WTO Panel, WT/DS114/R, adopted 7 April 2000.
9. Chimni, B. S., "The philosophy of patents: Strong regime unjustified", Journal of Scientific & Industrial Research, vol. 52 (1993), 234.
10. Chisum, Donald A, Principles of Patent law (New York: Foundation Press, 2001).
11. Damodaran, "EMR for Glivec: A TRIPS-dictated 'Cure'?, Financial Express, Jan. 9, 2004, I.
12. David Lange, Mary La France and Gary Mayers, Intellectual Property: Cases and Materials (St. Paul: West Group, 1998).
13. Dhar et al., Regime of Intellectual Property Protection for Biodiversity: A Developing Country Perspective (N. Delhi: RIS, 2001);
14. Dhavan, Rajeev, Harris, Lindsay and Jain, Gopal, "Conquest by Patent: The Paris Convention Revisited", 32 Journal of Indian Law Institute (1990), 131.
15. Diamond v. Chakrabarty, Supreme Court of the United States, 1980. 447 U.S. 303, 100 S. Ct. 2204, 65 L. Ed. 144, 206 USPQ 193.
16. Dutfield, G., Intellectual Property Rights and the Life Science Industries (London: Ashgate, 2002).
17. Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co. Ltd., et al., Supreme Court of the United States, May 28, 2002.
18. Gana, "Has Creativity Died in the Third World? Some Implications of the Internationalization of Intellectual Property", 24 Denver J of Int. L. & Policy (1995), 109;
19. Gervais, Daniel, The TRIPS Agreement: Drafting History and Analysis (London: Kluwer, 1998).
20. Griffith v. Kanamaru, US Court of Appeal for the Federal Circuit, 1987, 816 F. 2d 624.
21. Henderson, Elizabeth, "TRIPs and the Third World: The Example of Pharmaceutical Patents in India", European Intellectual Property Review, vol. 19, no. 11, (1997), 651.
22. Jayagovind, A., "The International Patent System and Developing Countries", Indian Journal of International Law (IJIL), vol. 20, no. 1 (1980), 47;
23. Juma, C., "Intellectual Property Rights and Globalization: Implications for Developing Countries", Science, Technology and Innovation, Discussion Paper no. 4, Center for Int. Dev., Harvard Univ., (1999)
24. Maggs, P. B., et al., Internet and Computer Law: Cases, Comments and Questions (St. Paul, Minn.: West Group, 2001);
25. Menon, Usha, "The Convention on Biodiversity, Intellectual Property Rights and Policy Options", Social Action, vol. 40, no. 2 (1992), 120.
26. Mishra, "Biodiversity, Biotechnology and Intellectual Property Rights: Implications for Indian Agriculture", 3 Journal of World Intellectual Property (2000), 211;
27. Nair and Kumar, eds., Intellectual Property Rights (N. Delhi: Allied, 1994);
28. Narayanan, P., Patent Law (Kolkata: Eastern Law House, 1998);
29. Patel, Surendra J., "Intellectual Property Rights in the Uruguay Round: A Disaster for the South", EPW, May 6 (1989), 978;
30. Ravishankar A. and Sunil Archak, "Intellectual Property Rights and Agricultural Technology: Interplay and Implications for India", 35 EPW (2000), 2446.

31. Robert A. Gorman and Jane C. Ginsburg, Copyright: Cases and Materials (New York: Foundation Press, 2002).
32. Sahai, "TRIPS Review: Basic Rights Must be Restored", 36 Economic and Political Weekly (EPW) (2001), 2918;
33. Saxena, R. B., "Trade-Related Issues of Intellectual Property Rights and the Indian Patents Act—A Negotiating Strategy", World Competition, vol. 12, no. 2 (1988), 81;
34. Stewart, S.M., International Copyright and Neighbouring Rights (London: Butterworths, 1983);
35. Twinomukunzi, Charles, "The International Patent System—A Third World Perspective", Indian Journal of International Law, vol. 22 (1982), 31;
36. United States – Section 110(5) of the US Copyright Act, Report of WTO Panel, WT/DS160/R, adopted 27 July 2000.
37. Watal, Intellectual Property Rights in the WTO and Developing Countries (Delhi: OUP, 2001);
38. Zutschi, "Bringing TRIPS into the Multilateral Trading System", in Bhagwati and Hirsch, eds., The Uruguay Round and Beyond: Essays in Honour of Arthur Dunkel (Heidelberg: Springer, 1998), 37.

Course Code	Course Title		L	T	P	Total
BBBL16F8300	**Quantitative Practice & Business Statistics**	HC	2	1	0	3

Course Objective:

To develop students' familiarity with the basic concepts and tools in statistics so as to enable them to resolve complex problems of decision making in business

Course Contents:

Unit- 1: Overview of Business Statistics
Definition, important and limitations; Functions and scope of statistics; Types of data; Data collection techniques; Presentation of data- tabulation, charting and diagrammatic

Unit- 2: Measures of Central Tendency and Variation
Central tendency- mean, median, mode, partition values; Variation – range, quartile deviation, average deviation, standard deviation, Lorenz curve; Skewness, moments and kurtosis

Unit - 3: Correlation and Regression analysis
Significance of study of correlation; Correlation and causation; Types of correlations; Measurement of correlation (Karl Pearson's methods, Spearman's rank correlation); Difference between correlation and regression; Bivariate regression model & regression equations of Y on X; Index Numbers; Times series analysis.

Unit– 4: Sampling & Tests of Hypothesis
Sampling and Sampling Distributions; Procedure of hypothesis testing; Type I and Type II errors; One tailed and two tailed tests; Testing of hypothesis with regard to large samples, about population means, difference between means, attributes, population proportion and difference between two proportions; Chi-square test; Analysis of Variance; Statistical decision making.

Text Books:

1. Gupta, S.P. & Gupta M.P. -Statistical Methods, Sultan Chand & Sons, N Delhi.
2. Sharma, J.K., Mathematics for Business & Economics, Asian Books, New Delhi.
3. Hooda, R.P., Statistics for Business and Economics, Macmillan, N. Delhi.
4. Levin & Levin: Business Statistics

Course Code	Course Title		L	T	P	Total
BBBL16F8400	**Interpretation of Statutes**	HC	3	1	0	4

Course Objective:

To equip the students with various tools of interpretation of Statutes

Course Contents

Unit – 1: Introduction

a. Meaning of Interpretation
b. Need for Interpretation

Unit – 2: Different parts of a Statute

Unit – 3: Rules of Interpretation

a. Literal Rule
b. Golden Rule
c. Mischief Rule

Unit – 4: External and Internal aids of construction

Text books:

1. Maxwell on the interpretation of statutes-Langan, P. St. J. (Peter St. John), Maxwell, Peter Benson
2. Principles of Statutory Interpretation - G.P. Singh

References:

1. Craies On Legislation: A Practitioners' Guide To The Nature, Process, Effect, And Interpretation Of Legislation - William Feilden Craies, Daniel Greenberg
2. The Construction of Statutes- Earl Theodore Crawford

SOFT CORE COURSES (OPTIONAL): Choose any Two

Course Code	Course Title		L	T	P	Total
BBBL16F8510	**Banking & Insurance Law**	SC	2	1	0	3

Course Objective:

In this paper the students will be taught the kinds of banks, their functions, and relationship with customers and the banking frauds, law relating to recovery of debts due to banks recovery of debts. Kinds of insurance and the body regulating the insurance sector will also be taught.

Course Contents:

Unit – 1: Banking System in India

a. Kinds of banks and their functions
b. Banking Regulation Laws
    i. Reserve Bank of India Act, 1934
    ii Banking Regulation Act, 1949
c. Relationship between banker and customer
    - Legal Character
    - Contract between banker & customer
    - Banks duty to customers
    - The Banking Ombudsman Scheme, 1995
    - Liability under Consumer Protection Act, 1986

Unit – 2: Lending, Securities and Recovery by Banks

a. Principles of Lending
b. Position of Weaker Sections
c. Nature of Securities and Risks Involved
d. Recovery of debts with and without intervention of courts / tribunal:
    i Recovery of Debts due to Banks and Financial Institutions Act, 1993
    ii Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act, 2002.

Unit – 3: Banking Frauds

a. Nature of Banking Frauds
b. Legal Regime to Control Banking Frauds
c. Recent Trends in Banking: Automatic Teller Machine and Internet Banking, Smart Cards, Credit Cards

Unit – 4: Insurance Law

a. Nature of Insurance Contracts
b. Constitution, Functions and Powers of Insurance Regulatory and Development Authority
c. Kinds of Insurance:
    (i) Life Insurance
    (ii) Medical claim
    (iii) Property Insurance
    (iv) Fire Insurance
    (v) Motor Vehicles Insurance (with special reference to third party insurance
    (vi) Application of Consumer Protection Act, 1986

Text books:

1. Banking Law & Negotiable Instruments Act – Sharma and Nainta
2. Banking System, Frauds and Legal Control – R.P. Namita
3. Law of Insurance – M.N. Mishra
4. Handbook of Insurance and Allied Laws – C. Rangarajan

Reference:

1. Banking Law & Practice in India – M.L. Tannan

Course Code	Course Title		L	T	P	Total
BBBL16F8520	**Women and Law**	SC	2	1	0	3

Course Objective:

To aims at creating awareness as to importance and role of women in society through the medium of law. It also focuses on women welfare laws.

Course Contents:

Unit–1: A. Introduction

i. Status of Women in India
ii. Status of Women – Position abroad

B. Constitution of India & Women

i. Preamble
ii. Equality Provision

Unit – 2: Personal Laws and Women

a. Unequal position of women – different personal laws and Directive principles of State Policy
b. Uniform Civil Code towards gender justice
c. Sex inequality in inheritance
d. Guardianship

Unit – 3: Criminal Laws and Women

a. Adultery
b. Rape
c. Outraging Modesty
d. Domestic Violence

Unit – 4: Women Welfare Laws

a. The Dowry Prohibition Act, 1961
b. Pre-conception and pre-natal diagnostic techniques (Prohibition of Sex Selection) Act, 1994
c. Indecent Representation of Women (Prohibition) Act, 1986
d. Immoral Traffic (Prevention) Act, 1987
e. Family Courts Act, 1984
f. Labour Welfare Legislations: Maternity Benefit Act, Factories Act, Equal Remuneration Act, Implementation of Wage Laws and Legislation on Women Employment

Text books:

1. Law relating to Women – Dr. Sayed Maqsood
2. Women and Criminal Law – Dr. S.C. Tripathi
3. Women Know Thyself - Law Relating to Women in India-Dr. Justice Sangita Dhingra Sehgal & Hasan Khurshid
4. Women & Law - Dr. S.R.Myneni
5. Women and Law – G.P. Reddy

Reference:

1. Women and Law – Prof.Nomita Aggarwal
2. Women and Law – Dr.ManjulaBatra

Course Code	Course Title		L	T	P	Total
BBBL16F8530	**Media Law**	SC	2	1	0	3

Course Objective:

This course will introduce students to the study of legal and ethical issues in the media. Students will develop an understanding and appreciation of these issues and the ability to analyze the important legal and ethical issues involved with the mass media industry.

Course Contents:

UNIT 1 - Introduction to Media law

Level of Knowledge: History of Press Laws in India- British to present, Press and Registration of Books Act 1867 - Parliamentary Proceedings (Protection of Publication) Act 1956 - Sedition - Criminal Procedure Code 1973 - Official Secrets Act 1923- Working Journalists Act, 1955. Specific Legal Issues Relevant to the Media: Defamation/Libel (both under the Law of Torts and Criminal Law)-Censorship (including constitution of the Censor Board, etc.)-Copyright (including under the new digital online data sharing/downloading/ buying technologies available today)-Obscenity - Contempt of Court - Parliamentary Privileges - Right to Information (especially under the Right to Information Act)- Video piracy - Cyber laws

UNIT 2 - The Legal Regime Concerning the Media in India

Level of Knowledge: Basic Concepts Press Commissions-Press Council Act 1978-Prasar Bharati Act 1990-Information Technology Act 2000-Prasar Bharati Board Self-Regulation of Media Organizations- Ethics- Broadcasting code - Code of conduct for various other media.

UNIT 3 - Political Aspects of Media

Level of Knowledge: Conceptual and Analytical Mahatma Gandhi's murder; Emergency; Terrorism: Kashmir, Punjab, LTTE; Naxalite movement, Andhra Pradesh, Karnataka, Assam; Chipko Movement; River Disputes; Language Issues: Hindi as national language; Ram Janmabhoomi issue; Mandal Commission; Godhra; Liberalization; coalition politics at the National and State level; Wars, Uniform Civil Code, Atrocities against Dalits.

UNIT 4 - Social Issues

Level of Knowledge: Conceptual and Analytical Mothers of Manipur – IromSharmila; Vaikom Movement; Caste and Temples - Entry of women into the temples - Shabrimala, Guruvayur temples; Changing Dynamics of Immigration - Gulf (Kerala), Brain-drain - USA and Europe; Literacy Movements - Kerala, Karnataka; Influence of Periyar, Raita Movement in Karnataka, case studies- Shahbano, trial by media- Jessica Lal and ArushiTalwar.

Text Books:

1. Blumer J.G. 1992. Television and the Public Interest, London Sage Publication.
2. Brain McNair. An Introduction to Political Communication
3. D.D Basu. 2002. Law of the Press, New Delhi Prentice Hall.

4. K.S. Venkateshwaran. 1993. Mass Media Laws and Regulations in India, Singapore AMIC.
5. Media Ethics and Laws –By Jan R Hakemulder, Fay A.C. de Jonge, PP Singh
6. Philip Seib and Kathy Fitzpatrick, 2000. Journalism Ethics, New York Harcourt Brace College Publishers

Course Code	Course Title		L	T	P	Total
BBBL16F8540	**Health Care Law**	SC	2	1	0	3

Course Objective:
To focus on various aspects of health care law including the constitutional perspective, obligations and negligence of medical professionals and remedies available to consumers of health care.

Course Contents:

Unit – 1: Medicine and Healthcare
a. Healthcare as an issue at the national and international level
b. Constitutional provisions
   - Right to Health as a Fundamental Right
   - Remedies available under the Indian Constitution
   - Right to health vis-à-vis the right to confidentiality
   - Access to medical records

Unit – 2: Professional Obligations of Doctors
a. Transplantation of Human Organs Act, 1994
b. Pre Conception & Pre Natal Diagnostic Techniques (Prohibition of sex selection) Act, 1994
b. International Code of Medical Ethics
c. Indian Medicine Central Council Act, 1970
d. Dentists Act, 1948
e. The Homeopathy Central Council Act, 1973
f. The Drugs and Cosmetics Act, 1940

Unit – 3: Medical Negligence
a. Ingredients
b. Role of consent in medical practice
c. Error of judgment and gross negligence
d. Wrongful diagnosis and negligent diagnosis

Unit – 4: Remedies for Medical negligence
a. Law of Torts
b. Law of Crimes
c. Consumer Protection Law

Text books:
1. Vijay Malik – Drug and Cosmetic Act, 1940
2. Anoop K. Kaushal – Medical Negligence & Legal Remedies

References:

1. Dr.Jagdish Singh – Medical negligence Compensation
2. B.K. Dutta – Drug Control

Course Code	Course Title		L	T	P	Total
BBBL16F8600	**Moot Court**	HC	0	0	2	2

SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the IX semester)

NINTH SEMESTER

Course Code	Course Title		L	T	P	Total
BBBL16F9100	**Alternate Dispute Resolution**	HC	3	1	0	4

Course Objective:

To acquaint students with various modes of ADR

Course Contents:

Unit – 1: Introduction

(1) Alternative Dispute Resolution (ADR): Concept and Need

(2) Legal Aid:

   a. Concept, Dimensions and Practice
   b. Constitutional Provisions
   c. Legal Services Authority Act, 1987
   d. Legal Literacy Mission

Unit – 2: Techniques of ADR – I

- Negotiation / Consultation
- Mediation
- Good offices

Unit – 3: Techniques of ADR – II

- Conciliation: Nature, Scope and Methods
- Arbitration – Arbitration agreement / Clause, Jurisdiction of the arbitral tribunal, Applicable Law; IIC, UNCITRAL, KSID.
- The Arbitration and Conciliation Act 1996

Unit- 4: Recognition and Enforcement

a. Indian Practice
b. International Practice

Text books:

1. International Dispute Settlement – J.G. Merrills
2. Alternative Dispute Resolution- Mark V.B. Partridge
3. Law of Arbitration and Conciliation Including other ADRs- S.K. Chawla

Acts:
1. Legal Services Authority Act, 1987

Course Code	Course Title		L	T	P	Total
BBBL16F9200	**Indirect Tax Law**	HC	3	1	0	4

Course Contents:

Unit 1: Central Sales Tax Act
Definition: Dealer, Place of Business, Sale, Sale Price (Sec.2)
Formulation of Principles for determining when a sale or purpose takes place in the course of Interstate Trade of Commerce or outside a State or in the Course of Import Export (Sec.3 to 5), Liability to Tax on interstate Sales (Sec.6), Registration & Cancellation and Penalties

Unit 2: Karnataka Tax Act /VAT (Value Added Tax)
Definition: Dealer, Goods Purchase, Sale, Turnover
Incidence of Taxation
Levy of additional Tax
Registration of Dealers
Voluntary Registration
Security from Dealers
Payments of Tax and Filing of Returns

Unit 3 - Assessment of Tax & its re-Assessment
Recovery of Tax & Penalty
Appeal, Revision, Rectification of Mistake
Penalty

Unit 4
Service Tax: Taxable service, Meaning and Importance of Service Tax, Constitutional Perspective, Salient provisions of the Service Tax Law
Gift Tax Act: Definition: Assessee, Assessing, Officer, Donor, Donne, Gift, Transfer of Property Charge of Gift Tax, Value of Gift,
Wealth Tax Act, VAT

Statutes:
The Central Sales Tax Act, 1956
Karnataka Trade Tax Act
The Wealth Tax Act, 1957

Text Books:
1. Bhagwati Prasad, Other Taxes in India
2. M.C. Mehrotra, Other Taxes in India
3. S.D.Singh, Principles of Sales Tax

Course Code	Course Title		L	T	P	Total
BBBL16F9300	**International Trade Law**	HC	3	1	0	4

Objective:
To introduce the subject to the students with special reference to India's role and place in the multi-lateral trading represented by the WTO.

Course Contents:

Unit – 1: Trade in Goods I
a. General Agreement on Tariffs and Trade (GATT)
b. Agreement on Agriculture
c. Agreement on Sanitary and Phyto sanitary Measures
d. Agreement on Technical Barriers to Trade

Unit-2: Trade in Goods II
a. Agreement on Trade-Related Investment Measures
b. Agreement on Subsidies and Countervailing Measures
c. Anti-dumping Agreement
d. Agreement on Safeguards

Unit – 3: Trade in Services
a. General Agreement on Trade in Services
b. Ongoing Multilateral Negotiations

Unit – 4: International Trade Dispute Resolution
a. Nullification or impairment
b. Dispute settlement
c. Enforcement and Remedies

Text books:
1. Indira Carr- Peter Stone - International Trade Law.
2. Myneni S.R. - The World Trade Organization.
3. Clive M Schmith off- Export Trade: The Law and Practice of International Trade.
4. Rajiv Jain- Guide on Foreign Collaboration: Policies and Procedures.
5. Singhania- Foreign Collaborations and Investment in India: Law and Procedures.
6. Jayanta Bagachi – World Trade Organisation: An Indian Perspective, Eastern Law House

References:
1. Results of the Uruguay Round of Multilateral Trade Negotiations: The Legal Texts (Geneva: GATT Secretariat, 1994).
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Course Code	Course Title		L	T	P	Total
BBBL16F9400	**Research Methodology (Presentation of Research Papers and Seminars)**	HC	0	0	3	3

Research Methodology:

Unit - 1 & Unit- 2

Types of methodology – comparative, descriptive, diagnostic, exploratory, experimental

a. Research methods, difference between Methods and Methodology
b. Tools of data collection- Observation, interview, questionnaire and schedule, genealogy, case study, sampling
c. Steps Research: Conceptualizing problem, laying down hypothesis, defining the variables, choosing the tools of data collection, phase of data collection, data analysis

- **Seminars ,Research paper and presentation of the Research paper**

SOFT CORE COURSES (Optional): Choose any Two

Course Code	Course Title		L	T	P	Total
BBBL16F9510	**International Economic Law**	SC	2	1	0	3

Course Objective:

To make students aware of the importance of International Economic Laws and governing principles with special references to India

Course Contents:

Unit – 1: Introduction

a. Definition
b. New International Economic Order

Unit – 2: Subjects of International Economic Law

a. States
b. Multinational Enterprises
c. Individual

Unit – 3: Major Economic Rights of States

a. Permanent Sovereignty
b. Non-intervention in domestic Affairs

Unit – 4: Dispute Settlements in International Economic Law

a. International Organizations

- IMF
- WTO

- EC

b. Between States and Foreign Investors

- ICC
- ICSID

Text books:

1. A.F. Lowenfeld – International Economic Law (New York Mathew Bender, 1979)
2. M. Bedjaoui – Towards a New International Economic order (Paris : UNESCO, 1979)
3. I.F.I. Shihata – Legal Treatment of foreign Investment (Dordrecht: Nijhoff, 1993)

Course Code	Course Title		L	T	P	Total
BBBL16F9520	**Air & space Law**	SC	2	1	0	3

Course Contents:

Unit- 1: Introduction to Air Law

a. Definition of Air Law- Nature, Scope and Development of Air Law
b. Institution and organs for the creation and administration of Air Law: International institutions –membership, organs and functions

Unit- 2: Introduction to Space Law:

a. Definition, nature and scope of Space Law
b. International Control and Cooperation
c. Extraterrestrial application of international law
d. The U.N. and development of international Law relating to outer space

Unit- 3: Safety and security in civil Aviation

a. The Concept, Aviation terrorism International Norms-conventions, protocols and regulations
b. Regulations in India Air Safety Provisions- Air Traffic management
c. Legal regime of Air Space and Outer Space
d. Problem of application of Air and Space laws - Air Navigation services, Sovereign rights of States

Unit 4:

a. Legal issues Liability in International civil aviation
b. New Development Technology in India and problem in civil aviation Airports
c. Leasing and privatization
d. Third party liability for surface damage
e. The International legal status of outer space objects, Satellites and Spacemen

Books:

1. S. Bhatt, The New Aviation Policy in India
2. V.S.Mani, Recent Trends in International Space and Policy
3. C.Wilfred Jenks – Space Law (London, Stevens & Sons)

Course Code	Course Title		L	T	P	Total
BBBL16F9530	**International Humanitarian and Refugee Law**	SC	2	1	0	3

Course Objective:
To make students aware of the principles of International Humanitarian Law and enable them to specialize in the field of Human Rights Law and Humanitarian Law

Course Contents:

Unit – 1: Introduction
- a. History
- b. Evolution
- c. Growth

Unit – 2: Geneva Conventions Systems
- a. Geneva Convention I, II, III, IV

Unit – 3: Armed Conflicts
- a. Internal armed conflict
- b. International armed conflicts
- c. Non-international armed conflicts

Enforcement Machinery
a. International Criminal Court
b. ICRC

Unit – 4: Refugee Law:
- a. Introduction: definition, historical development and structure of Refugee Law
- b. Rights, obligations and privileges of refugees under the Refugee Convention 1951
- c. Position of refugees under UDHR

Text books:

1. Ingrid Detter, The Law of War, (Cambridge)
2. A. Roberts and R. Guelff, eds. , Documents on the Laws of War (Oxford)
3. Legality of the Threat or Use of nuclear weapons, Advisory Opinion, ICJ Reports (1996)
4. M.K. Balachandran and Rose Verghese (eds.) – International Humanitarian Law ICRC (1997)
5. RavindraPratap, "India's Attitude towards IHL", in Mani (ed.) International Humanitarian Law in South Asia (Genava: ICRC, 2003)
6. Guy S. Goodwin – The Refugee in International Law (Oxford)

Course Code	Course Title		L	T	P	Total
BBBL16F9540	**Criminology**	SC	2	1	0	3

Course Contents:

Unit- 1: Criminology-Introduction

a. Nature, scope and extent of crime, Criminal Law and Criminology
b. Criminology General Approaches to Crime control organized Crime
c. Types of Crime(Violent Crime, Property Crime, White Collar Crime and Organized Crime, Consensual Crime)

Unit- 2:

a. Factor Responsible for Causation of Crime, Environment, home and community influences, urban and rural crimes
b. Criminal Justice Structure- the Police System, role and functions of Police under the Police Act and Cr.P.C.

Unit- 3: Penology and Victimology

a. Nature and Scope of Penology and Victimology
b. Compensation
c. Need for reformation and rehabilitation

Unit 4: Controlling and Preventing Crime

a. Theories of Punishment: (i) Deterrent Theory (ii) Retributive Theory (iii) Preventive Theory (iv) Reformative Theory
b. Re-socialization Process (Probation and Parole): Definition, Nature, Duties of Probation Officers, Difference between Parole and Probation, Authority for granting Parole, Supervisor of Parole, Problems of the released offender, Attitude of the community towards released offender, Prisoner Aid Society and other Voluntary Organization governmental Action.

Text Books:

1. Katherine S Williams, Textbook on Criminology
2. Loveland, Frontiers of Criminality
3. Loveland, Frontiers of Criminality

References:

1. Criminology –Larry Siegal
2. Criminology, Victimology and Penology –Dr.S.S.Srivastava
3. Criminology, Victimology and Penology- Prof. N.V.Paranjape
4. Criminal Law, Criminology and Administration of Criminal Justice- K.D.Gaur

Course Code	Course Title		L	T	P	Total
BBBL16F9600	**Summer Internship (Evaluation)**	HC	1	1	0	2

Evaluation Pattern:

As regards the internship, after the completion of internship by the students, the work done by the candidate as recorded in his/her daily diary along with a consolidated placement report would be evaluated by a Board of examiners consisting of (i) Dean/Director of the Institute; (ii) two faculty members and; (iii) an invitee from outside school/institute. The same Board would

also conduct the viva on internship also.

TENTH SEMESTER

Course Code	Course Title	L	T	P	Total
BBBL16F1010	**Dissertation**	HC	0	0	16

***Evaluation Pattern:**

The Dean/Directors will propose a panel of examiners to the Controller of Examination for evaluation of the dissertation and for conducting the viva. The examiners approved by the university will evaluate dissertation in consultation with the supervisor followed by a viva to be conducted by a Board consisting of:

i The External Examiner;
ii Dean/Director of the Institute;
iii Supervisor of the candidate;
iv One faculty member of the institute.

***MOOT COURT**

The Paper will have following components:

a) Moot Court: Every student may be required to do at least three moot courts in a year. The moot court work will be on assigned problem.

b) Observance of Trial in two cases, one Civil and one Criminal.
Students may be required to attend two trials in the course of the last two or three years of LL.B. studies. They will maintain a record and enter the various steps observed during their attendance on different days in the court assignment.

c) Interviewing techniques and Pre-trial preparations and Internship diary.
Each student will observe two interviewing sessions of clients at the Lawyer's Office/Legal Aid Office and record the proceedings in a diary. Each student will further observe the preparation of documents and court papers by the Advocate and the procedure for the filing of the suit/petition.

d) The fourth component of this paper will be Viva Voce examination on all the above three aspects.

e) Student will be required to undertake legal awareness programme in association with N.S.S. and other authorities as directed by the Faculty.

Training and Placement:

Having a degree will open doors to the world of opportunities for you. Whether it is to become practitioners, entrepreneurs, or looking for descent job, apart from subject knowledge, you need skills that enable you to stand out from the crowd and exhibit real life skills that can be applied to anywhere and in any organization. Examples of such popular skills that today's graduates need include:

- Willingness to learn
- Self motivation
- Team work
- Communication skills and application of these skills to real scenarios
- Requirement of gathering, design and analysis, development and testing skills
- Analytical and Technical skills
- Computer skills
- Internet searching skills
- Information consolidation and presentation skills
- Role play
- Group discussion, and so on

The REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling, Training and Placement (CCTP) Centre headed by well experienced dynamic Trainer, Counselor and Placement Officer supported by an efficient team does handle all aspects of Internships and Placement for the students of REVA University. The prime objective of the CCTP Centre is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CCTP Centre organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CCTP Centre forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality. The University has signed MOU's with Multi-National Companies, research institutions and universities abroad to facilitate greater opportunities of employability and as well students' exchange programs for higher learning.

The scope of legal education has grown beyond the boundary of traditional areas of study. Today's law graduates, apart from practicing and working in judiciary have plenty of opportunities in different areas in various sectors such as public policy, business, Indian and Foreign Law Firms, Multi National Companies, Legal Cells of Private and Public Sector

Companies, Legal Department of Foreign Companies, Global Audit and Compliance Firms, Consulting Firms, media houses etc., They WOULD shape their career as lawyers, legal journalists, managers, business heads, and so on. Keeping this as focus the training and placement cell has designed the training process in the curriculum. Special coaching in personality development, career building, English proficiency, reasoning puzzles, leadership, strategic management and communication skill to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their interpersonal skills that will not only help them to be successful practitioners but also to fetch a job of repute and to choose a proper path.

The students undergo training during the internship in 9th & 10th Semesters. This helps them to explore job in reputed offices / firms all over the world to build up their career. Many students will continue in these reputed offices for better prospects and few take of advantage of this experience and become reputed practicing architects developing their own firms.

FACULTY PROFILE

Prof. Neha Mishra, Assistant Professor in the School of Law, holds LL.M from National Law School of India University specializing in Human Rights Law and currently pursuing her PhD from the same institution. She also holds M.A. from Hindu College, Delhi University. She has worked as an Attorney and has a total industry experience of 6 years and a teaching experience of 2 years. She has presented her papers globally and authored articles and research papers for international journals. She also has been a part of various national and international conferences, seminars and workshops. Her area of interest includes International Human rights law, the study of Exclusion and Constitutional law.

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Dr Harani.B Assistant Professor, School of Commerce, REVA University she holds M.A (Eco), M Com, M Phil and PhD in Economics from University of Madras, Chennai. She has 8 years of teaching experience in various institutions including REVA Institute of Science and Management. She has attended and presented papers in various International Conferences and National Seminars and also participated Faculty development programs.

Prof. Manish K Salian, Assistant Professor, School of Legal Studies holds LL.M. degree in Business and Trade Law from Karnataka State Law University and BA (Law) LL.B degree from Mangalore University. He has 3 years of corporate and teaching experience. He is teaching Indian Constitution and Professional Ethics, Police Administration, Police Act and Indian Evidence Act.

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Prof. Chithambar Gupta V, Associate Professor, School of Management Studies, holds a Masters degree in Management from the Indian Institute of Science (IISc), Bangalore and B.Tech degree in "Civil Engineering" from JNTU. He has 16 years of work experience of which 6 years of Industry experience and 10 years of teaching experience. He is teaching Strategic Management, Business Research Methods, Marketing Management, Services Marketing, Consumer Behaviour, Integrated Marketing Communication, Retail Management, Management Information Systems and Entrepreneurship Development to MBA and other students. He has organized several Management Fests, Workshops and Seminars. He has won various awards and accolades for his work in management studies. He has published papers in management journals and presented papers in conferences. He is pursuing research on 'Franchising and Retailing' leading to PhD in Management Studies.

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Prof. Shivasharana, Sr. Assistant Professor in School of Commerce and Management Studies, possesses B Sc in Mathematics from Bangalore University and MBA from Bharatidasan University. He also has Post Graduation in Computers from CMC, Bangalore and M Phil degree. He has 16 years of teaching experience and 6 years of industry experience. Currently he is pursuing research leading to PhD in Management Studies.
Email Id- shivasharan.a@revainstituion.org

Prof. MANJUNATH B, Sr. Assistant Professor, School of Computer Applications, holds M.S degree in Information Technology and B.E degree in Computer Science and Engineering from Bangalore University. He has 14 years of teaching experience. His areas of teaching include: Logic Design, Digital Electronics, Computer Graphics, ERP, UID, Computer Organization, DBMS, E-Commerce & Mobile Commerce, and Distributed Objects. He is pursuing his research in Distributed Systems. (Email ID: manjunath_b@revainstitution.org)

Prof. Shyla Abraham, Asst. Professor, School of English has Masters degree in English. She has 14 years of teaching experience. Shyla Abraham has participated in various Faculty Development programs, workshops and refresher courses conducted in English.

Prof. Ishrath Begum, Assistant Professor, School of Legal Studies, at REVA University holds B. Sc., LLB., LLM degree from Bangalore University. She has 10 years of teaching experience, teaching various subjects like Constitution of India, Contract Law, Jurisprudence, Indian Panel Code, etc., She has participated in many workshops held by National School of Law, Bangalore University and others.
Email ID: ishrathbegum@revainstitution.org

Prof. Radha D R, Assistant Professor, School of English, holds MA degree in English from Kuvempu University. She has 3 years of teaching experience, teaching various subjects like Logic Communicative English, Technical English, She is pursuing research in Post-colonial studies.
Email ID: radhadr@reva.edu.in

DO'S AND DON'TS

DO'S

1. Maintain discipline and respect the rules and regulations of the university
2. Be regular and punctual to classes
3. Study regularly and submit assignments on time
4. Be respectful to your Teaches/friends and hostel staff/management.
5. Read the notice board (both at your college and the hostel) regularly.
6. Utilize your Personal Computer for educational purpose only.
7. Follow the code of conduct.
8. Visit Health Center on the campus whenever you are unwell.
9. Be security conscious and take care of your valuables especially Cash, Mobile Phones, Laptop and other valuables.
10. Carry your valuables along with you whenever you proceed on leave/vacation.
11. Use electric appliances, lights and water optimally.
12. Keep the campus clean and hygienic.
13. Use decent dressing.

DON'TS

1. Ragging inside / outside the campus.
2. Possession of Fire arms and daggers etc.
3. Use of Alcohols, Toxic drugs, sheesha, gutkha and hashish/heroin etc.
4. Use of Crackers, explosives and ammunition etc.
5. Smoking and keeping any kind of such items.
6. Misusing college & hostel premises/facilities for activities other than studies.
7. Playing loud music in the room which may disturb studies of colleagues / neighbors.
8. Making noise and raising slogans.
9. Keeping electrical appliances, other than authorized ones.
10. Involvement in politics, ethnic, sectarian and other undesirable activities.
11. Proxy in any manner.
12. Use of mobiles in the academic areas.

Note: 1. Rules are revised / reviewed as and when required.

2. Healthy suggestions are welcome for betterment of Institution

10 YEARS OF UNIVERSITY RECOGNITION
20 YEARS OF ACADEMIC EXCELLENCE

REVA UNIVERSITY
Bengaluru, India

School of CSA

Master of Science in Computer Science (MS-CS)

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CONTENTS

Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of Reva University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr. K. Mallikharjuna Babu
Vice-Chancellor, REVA University

Director –Message

Welcome note to students

It's my pleasure to welcome you to the School of Computer Science and Applications. Computer, being considered as most significant and revolutionary invention of mankind has metamorphosed the planet earth completely. Predominantly School of Computer Science and Applications have acquired the control of the modern life in a myriad way.

The MS (Computer Science) program is designed keeping in view the current situation and possible future developments, both at national and global levels. This program is designed to give greater emphasis on computer science. There are ample number of courses providing knowledge in specialized areas of network security, python programming and cloud computing etc. facilitating students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts in computer applications.

The program is designed to expose students to various subjects having applications in computers, IT and electronics related industries through outcome based teaching and learning process which emphasizes practical exposure rather than memorization. A variety of activities such as mini projects, seminars, interaction with industries, cultural activities and social activities are in place to shape the all-round development of students.

The benefits of choosing MS (Computer Science) program are:

- Flexibility to choose various fields upon graduation.
- Opportunity to work on live problems.
- Opportunity to work on environmental related technologies.
- Opportunity for programmers to develop software for varied applications in different sectors.

Students after successful completion of MS (Computer Science) program:

- Can start-up their career in either government sector or private sector since there are ample employment opportunities in these sectors.

- Can also start their career as software programmers / engineers, testing engineers, data base administers, system and network administrators, multimedia / web programmers, web designers etc.,
- Can seek placements in diversified fields like banking, e-commerce, insurance, entertainment, and such others.
- The computer application trained graduates are sought after by varied firms for their software based skills.
- Can opt for higher studies in computer science, IT, business management and so on.

The curriculum caters to and has relevence to local, reginal, natinal and global development needs. All courses are focussed on building skill, employability and entrepreneurship of students. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

I am sure the students choosing MS (Computer Science) in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance. We will strive to provide all needed comfort and congenial environment for their studies. I wish all students pleasant stay in REVA and grand success in their career.

Dr. S. Senthil
Director – School of Computer Science and Applications

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. **Rukmini Educational Charitable Trust** (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 12000+ students studying in various branches of knowledge at graduate and post graduate level and 302 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The

Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano-Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is 'Life Time Achievement Award' to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the "Founders' Day Celebration" of REVA University in presence of dignitaries, faculty members and students gathering and the first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO on the occasion of Founder's Day Celebration, 6th January, 2016 and the second "REVA Life Time Achievement Award" for the year 2016 has been awarded to Shri. Shekhar Gupta, Renowned Journalist on the occasion of Founder's Day Celebration, 6th January, 2017.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year

students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honoured with many more such honors and recognitions.

REVA University Vision

‘’REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards”.

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

ABOUT SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

The School of Computer Science and Applications is shouldered by well qualified, experiencedand highly committed faculty. The state-of-the-art infrastructure digital classrooms, well equippedadvanced computer laboratory, conference rooms and the serene academic atmosphere at REVAUniversity will enhance the transfer as well as creation of knowledge. The School offers BCA,B. Sc. (Honors) in Computer Science with specialization in Cloud Computing and Big Data,MCA and MS (Computer Science) programs. The School also has research program leading todoctoral degree. The curriculum of both graduate and post graduate degree programs have beendesigned to bridge the gap between industry – academia and hence they are industry oriented.These programs provide ample scope to enter into a wide range of business opportUNITies,entrepreneurship ventures and as well as job opportUNITies in different sectors. This is reflected invarious core subjects / courses offered within the program. Further the school provides aninteractive, collaborative peer tutoring environment that encourages students to break downcomplex problems and develop strategies for finding solutions across a variety of situations anddisciplines. The school aims to develop a learning commUNITy of critical thinkers who serve asmodels of innovative problems solving in the university environment to enrich their academic andprofessional careers.

VISION

To transform students into good human beings, responsible citizens and competent professionals, focusing on assimilation, generation and dissemination of knowledge in the area of Computer Applications

MISSION

- To impart quality education to meet the needs of profession and society, and achieve excellence in teaching-learning and research in the area of Computer Applications;
- To attract and develop talented and committed human resource, and provide an environment conducive to innovation, creativity, team-spirit and entrepreneurial leadership in Computing field;

- To facilitate effective interactions among faculty and students of the School of Computer Applications, and foster networking with alumni, industries, institutions and other stake-holders; and
- To practice and promote high standards of professional ethics, transparency and accountability.

OBJECTIVES

- To impart programs at graduate, post-graduate and doctoral levels in the field of computer applications;
- To adopt innovative methods of teaching and promote student centric learning process;
- To create infrastructure of international standard and facilitate and create conducive environment for teaching, learning and research;
- To promote faculty development and encourage faculty members and students to organize and participate in national and international level conferences, seminars, symposia and such others;
- To encourage teachers and students to take-up interdisciplinary studies and research;
- To promote students participation in co-curricular and extension activities and develop their personality traits and team spirit

ADVISORY BOARD

SL. No	Name and Affiliation
1	Dr. B.S.Anami Principal, KLE Institute of Technology, Hubli.
2	Dr.M N Birje Professor &Head, Department of Computer Applications, VTU,Belagvi.
3	Dr.Sathish Babu Professor & Head, Department of Computer Science, SIT,Tumkur.
4	Dr.P Nagabhusan Director, IIIT Allahabad.
5	Dr.Pethuru Raj Chief Architect & Vice President, Site Reliability Engineering (SRE), Division, Reliance Jio Infocomm Limited.
6	Mr.Raja Krishnamoorthy Director, SAP, Cognizant Technology Pvt.Ltd, Bengaluru.
7	Dr.Madan Kumar Srinivasan Associate Vice President, AI Innovation Centre, Accenture, Bengaluru.

MASTER OF SCIENCE in COMPUTER SCIENCE (MS-CS) PROGRAM

Programme Overview

Computers have become ubiquitous part of modern life, and new applications are introduced every day. The use of computer technologies is also commonplace in all types of organizations, in academia, research, industry, government, private and business organizations. As computers become even more pervasive, the potential for computer-related careers will continue to grow and the career paths in computer-related fields will become more diverse. Since 2001, global information and communication technologies (ICTs) have become more powerful, more accessible, and more widespread. They are now pivotal in enhancing competitiveness, enabling development, and bringing progress to all levels of society.

The career opportUNITies for Master of Science in computer science graduates are plenty and growing. Programming and software development, Information systems operation and management, telecommunications and networking, computer science research, web and Internet, graphics and multimedia, training and support, and computer industry specialists are some of the areas where the graduates find opportUNITies.

The School of Computer Science and Applications at REVA UNIVERSITY is offering Master of Science in Computer Science (MS) –a two year postgraduate programme. The aim of the programme is to create motivated, innovative, creative thinking graduates to fill in the roles of Software Engineers who can conceptualize, design, analyze and develop computer software to meet the modern day industry requirements.

This MS programme in Computer Science is offered by **School of Computer Science and Applications at REVA UNIVERSITY in collaboration with University of Alabama in Huntsville (UAH), USA. The students of this programme who completes first year of study successfully at REVA University has a choice either to pursue their second year of study at UAH or continue in REVA.**

The programme is designed to develop human resources to meet the challenges of ever-growing technologically advanced IT industry and digital revolution. The programme deals with important present day topics like data analytics; information security; Data warehousing and Data mining; mobile application development and cloud computing.

Program Educational Objectives (PEO's)

The aim of the programme is to produce postgraduates with advanced knowledge and understanding of Computer Science; higher order critical, analytical, problem solving and

transferable skills; ability to think rigorously and independently to meet higher level expectations of ICT industry, academics, research establishments or take up entrepreneurial route.

The Programme Educational Objectives are to prepare the students to:

PEO-1	Be skilled Computer Application Developers, Use existing algorithms to develop computer applications, Provide computer based solutions for real life problems, Design, develop and test software /computer applications for specific needs
PEO-2	Understand the concepts and theories behind computer science and Adapt to the upcoming trends and technologies to the level of developing of commercially viable, robust and reliable software by ensuring that projects are completed satisfactorily, on time, and within budget ,
PEO-3	Work as a member of a team and communicate effectively across team members, to be equipped to be competent in the field of computer science and be equipped to act as a business administrators or as administrators in public, private and government organisations or become an entrepreneur.
PEO-4	understand environmental, legal, cultural, social, ethical, public safety issues work along with engineering, medical, ICT professionals and scientists to assist them in their research and development work after further training

Program Outcomes (POs)

After undergoing this programme, a student will be able to:

PO 1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of computer science that form a part of the graduate programme Master of Science in Computer Science

PO 2: Scientific reasoning: Ability to analyse, and understand concepts in computer science, and explain the theories behind computer science. critically evaluate ideas, logical reasoning and experiences in programming, software development and application development.

PO 3: Problem solving: Capacity to extrapolate and apply competencies to solve different kinds of non-familiar problems, such as solving of real life problems through computing, provide Solutions to computing problems, analyze existing algorithms of different applications, design and develop new algorithms, operate various commercial software tools to solve scientific and business problems

PO 4: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development and provide solutions for the same using domain knowledge in Computer science.

PO 5: Research-related skills: Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation in current technologies.

PO 6: Ethics: Conduct as a responsible citizen by recognizing different value systems and understand and accept responsibility of the moral dimensions and take decisions which conform to cultural, environmental, sustainability and ethical issues for them.

PO 7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO 8: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups

PO 9: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

Programme Specific Outcomes (PSO)

After successful completion of the programme, the graduates will be able to

1. Apply the latest trends in technology to design, develop and test software applications for specific needs.
2. Explore the concepts and theories behind computer science to develop innovative software applications.
3. Instill life-long learning skills through the development of a research environment and higher educational opportunities.

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

Master of Science in Computer Science – MS (CS) Programme
Scheme of Instructions-2020

FIRST SEMESTER

SL. No.	Course Code	Course Title	HC/SC/ FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M20MS1010	Big Data Analytics	HC	2	1	1	4	6
2	M20MS1020	Object Oriented Programming with Java	HC	2	1	0	3	4
3	M20MS1030	Data Mining and Knowledge Discovery	HC	2	1	0	3	4
4	M20MS1040	Advanced Computer Networks	HC	4	0	0	4	4
5	M20MS1050	Probability & Statistics	HC	4	0	0	4	4
6	M20MS1061	Advanced Operating Systems using Linux	SC	2	0	1	3	4
	M20MS1062	Advanced DBMS						
	M20MS1063	Advanced Web Technologies						
Practical Courses								
7	M20MS1070	Java Lab	HC	0	0	2	2	4
8	M20MS1080	Data Mining Lab	HC	0	0	2	2	4
***Mandatory - (Non Creditable Courses)**								
9	M20MS1090	Skill Development Programme						
Total Credit				**19**	**3**	**6**	**25**	**33**

SECOND SEMESTER

SL. No	Course Code	Course Title	HC/ SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M20MS2010	Machine Learning using Python	HC	4	0	0	4	4
2	M20MS2020	Linear Algebra	HC	4	0	0	4	4
3	M20MS2030	Big Data with NoSQL	HC	4	0	0	4	4
4	M20MS2041	System Modeling and Simulation	SC	2	1	0	3	4
	M20MS2042	Pattern Recognition						
	M20MS2043	Human Computer Interaction						
5	M20MS2051	Software Project Management	SC	2	1	0	3	4
	M20MS2052	Social Network analysis						
	M20MS2053	Business Intelligence						
6	M20MS2061	Mobile Computing And APPstore Management	SC	2	1	0	3	4
	M20MS2062	Service Oriented Architecture						
	M20MS2063	Internet of Things						
Practical Courses								
7	M20MS2070	Python Lab	HC	0	0	2	2	4
8	M20MS2080	NoSQL lab	HC	0	0	2	2	4
***Mandatory - (Non Creditable Courses)**								
9	M20MS2090	Soft Skill						
10	M20MS2100	Skill Development Programme						
Total Credits				18	3	4	25	32

THIRD SEMESTER

SL. No	Course Code	Course Title	HC/SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	M20MS3010	Cloud Computing	HC	4	0	0	4	4
2.	M20MS3021	Intelligent Systems	SC	2	1	0	3	4
	M20MS3022	Deep Learning Techniques						
	M20MS3023	Ubiquitous and Pervasive Computing						
3.	M20MS3031	Advanced Image Processing and Analysis	SC	2	0	1	3	4
	M20MS3032	Multivariate Methods for data Analysis						
	M20MS3033	Advanced Java Programming						
4.	M20MS3040	Open Elective ******	OE	4	0	0	4	4
5.	M20MS3050	Minor Project	HC	0	0	6	6	12
***Mandatory - (Non Creditable Courses)**								
6.	M20MS3060	Soft Skills						
7.	M20MS3070	Skill Development Programme						
Total Credits				**12**	**1**	**7**	**20**	**28**

Course Code	Digital Marketing	Course Type	L	T	P	C	Hrs. /Wk.
M20MS3040		OE	4	0	0	4	4

FOURTH SEMESTER

SL. No	Course Code	Title of the Course	Credit Pattern L:T:P:J	Credits
1	M20MS4010	Research/Technical paper	0:0:0:2	2
2	M20MS400	Internship/ Certification	0:0:0:6	6
3	M20MS4030	Major Project	0:0:0:12	12
Total Credits				**20**

*** Note:**

1. Project Work and Dissertation will be mandatory of 12 Credits

2. The student can select either Internship (4 weeks) or Certification Course for 6 Credits.

3. All final year project students must write & publish a technical/Research paper based on their area of interest that carries 2 credit.

SEMESTER WISE CREDIT SUMMARY

Semester	Credits
First	25
Second	25
Third	20
Fourth	20
Total	**90**

CREDIT DISTRIBUTION

Sem	Hard Core (HC)	Softcore Course(SC)	Open Elective(OE)	Project& Technical Paper	Internship/ Certification	Total Credits
I	22	3	-	-	-	25
II	16	9	-	-	-	25
III	10	6	4	-	-	20
IV	-	-	-	12 + 2	6	20
						90

Master of Science in Computer Science – MS (CS)
Detailed Syllabus

FIRST SEMESTER

M20MS1010	Big Data Analytics	L	T	P	C
Duration:52 Hrs		2	1	1	4

Course Description

This course content describes the overview of Big Data, using big data in businesses, technologies for handling huge data's, Understanding Hadoop ecosystem which includes deep understanding of the fundamental MapReduce , it covers the entire framework of MapReduce and uses of MapReduce with testing and debugging MapReduce Applications and how we are using Hadoop to store data.

Prerequisites:

Data base Management System, Data mining

Course Objectives:

The objectives of this course are to:

- Analyze the basic challenges in handling big data.
- Explore the fundamental concepts of big data analytics
- Compare the types of Data analytics
- Discover the challenges in Big data processing for analytics using R

Course Outcomes:

On successful completion of this course; the student will be able to:

- Determine the challenges in working with big data platform
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Analyse the fundamentals of various big data analysis techniques.
- Demonstrate Map Reduce Concepts in Big Data processing.

Course Contents:

UNIT I Introduction to Big Data **13 Hours**

Introduction to BigData and its importance, Understanding the Characteristics of Big Data-The Vs, Types of Data- Examples of structured, unstructured and Semi-structured data. Understanding the Waves of managing Data, Big Data architecture, Big Data Technology Components.

Industry examples of Big Data , big data and Digital marketing, fraud and big data, risk and big data, credit risk management, big data and healthcare, advertising and big data.

Mobile business intelligence, Crowd sourcing analytics.

UNIT II Data Science and BigData Analytics **13 Hours**

Data Science: Business Intelligence vs Data Science. Role of a Data scientist, Profile of a Data Scientist. Big Data Analytics- Importance, Types of Big data Analytics: Diagnostic, Descriptive, Predictive and Prescriptive analytics. Data Analytics Life cycle –the six Phases Viz. Discover, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.Analysis Vs Reporting, Modern Data Analytic Tools

UNIT III Data Analytics process and Hadoop Related Tools **13 Hours**

Advanced clustering: K means, Regression, Regression models, Text Analytics, Analytics for Unstructured data.Technologies and tools: Introduction to distributed computing, Hadoop and Hadoop Eco system, cloud and big data, Introducing Map Reduce. Examples of Map Reduce.

UNIT IV R Programming and Data Analytics **13 Hours**

Using R for analytics: Introduction to R, Analyzing and exploring data, methods for model building and Evaluation.Data Visualization: data Visualization techniques and methods, problems and Case Studies.Use cases– Text analytics, Web analytics

Text books:

1. AmbigaDhiraj, Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition,Wiely CIO Series, 2013.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, and Marcia Kaufman, Big Data For Dummies, Wiley,2013
3. Data Science and Big Data analytics, EMC2 Educational services, Wiley,2015

4. Bill Franks, “Taming the Big Data Tidal Wave: Finding OpportUNITies in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012.
5. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

References:

1. Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics For Enterprise Class Hadoop And Streaming Data”, Mcgrawhill Publishing, 2012
2. Glenn J. Myatt, “Making Sense Of Data”, John Wiley & Sons, 2007
3. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

UNITWise Text Books:

UNIT-I:

Text 2:Big Data For Dummies Part I and II

Text 1:Chapters 1 and 2

UNIT-II:

Text Book 3: Chapter 1

Text Book 2: Part IV

UNIT-III:

Text book 3: Chapter 2

UNIT-IV:

Text book 4: Chapter1, 2

M20MS1020	Object Oriented Programming with JAVA	L	T	P	C
Duration: 40 Hrs		2	1	0	3

Course Description

Java is a general-purpose programming language that is Robust, Platform Independent, compiled and interpreted. It is intended to let application developers “Write Once Run Anywhere”, meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to ”Bytecode” that can run on any JVM regardless of the Computer Architecture.

Prerequisites:

C Programing

Course Objectives:

The objectives of this course are:

- Understand fundamentals of object-oriented programming in Java, including defining Classes, invoking methods, using class libraries, exception handling etc.
- Understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Develop simple Java programs, debug and execute using Java SDK environment
- Develop object oriented Applications using packages, interfaces, threads with Exception handling mechanism.

Course Outcomes:

On successful completion of this course; the student shall be able to:

- Implement Java classes from specifications.
- Effectively create and use objects from predefined class libraries.
- Use interfaces, inheritance, and polymorphism as programming techniques
- Use exceptions and multithreading.

Course Contents:

UNIT I Introduction to OOPS & JAVA Programming 10 Hours

Fundamentals of object –oriented programming: Introduction, Object_oriented Paradigm, Basic concepts of Object-oriented programming: objects & classes, Data Abstraction & Encapsulation, Inheritance, Polymorphism, Dynamic Binding , Message communication. Benefits & Applications of OOP **Java Evolution:** Java History, Java Features, How Java Differs from C & C++?, Java Environment.

UNIT II Types, Arrays, Control Statements, String , Classes & Objects: 10 Hours

Data Types, Variables & Arrays, Operators, Control Statements. **String Handling:** The String Constructors, String Length, Special String Operations, String Comparison, StringBuffer. **Classes, Objects and Methods:** Introduction, Defining a class, Declaration of Fields & methods, Creating Objects, Accessing the class members, Constructors, Methods Overloading, Static members, Nesting of methods.

UNIT III Inheritance, Packages & Interfaces, Exception Handling: 10 Hours

Inheritance, Final Variable and Methods, Final Classes, Finalizer Methods, method overriding, Abstract Methods and Classes, visibility control. **Packages and Interfaces:** Packages – importing packages – interfaces.

UNIT IV Exception Handling , Multithreading And Applets 10 Hours

Exception Handling: Fundamentals – types – Uncaught Exceptions – Using try and catch – throw-throws-finally –Builtin Exceptions – User defined Exceptions. Multithreaded Programming: The Java Thread model, Thread priorities, Thread class anad Runnable Interface, main Thread, Creating a Thread,& Multiple Threads, Extending a Thread, Using isAlive() and join(),suspend(), resume(), stop() – Synchronization, InterThread Communication. Applet Class: Applet Basics- Applet Initialization and Termination Display methods - A Simple Banner Applet.

Text books:

1. Herbert Schildt, Java 2: The Complete Reference. 5th Edition, McGraw-Hill Education Group.(Chapter 3,4,5,9,10, 11, 13 & 19)
2. E. Balagurusamy, Programming with Java – A Primer 3rd Edition, McGraw-Hill companies.(Chapter 1,2, & 8)

Reference Books:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals, A comprehensive Introduction" - Tata McGraw Hill Edition 2013.
2. Deitel and Deitel, "Java How to Program", 9th Edition, PHI publisher,2013.
3. Herbert Schildt, "Java™: The Complete Reference, 2014", 9th Edition, Oracle Press.
4. Aaron Walsh and John Fronckowick, "Java Bible, Programming Version 2", IDG Books Worldwide, Inc. 2000.

M20MS1030	Data Mining and Knowledge Discovery	L	T	P	C
Duration: 40 Hrs		2	1	0	3

Course Description

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. It is currently regarded as the key element of a more general process called Knowledge Discovery that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be give to the Machine Learning methods as they provide the real knowledge discovery tools.

Prerequisites:

Data Base Systems

Course Objectives:

The objectives of this course are to:

- Learn data analysis techniques through Data Mining.

- Understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.
- Identify and distinguish the process of Knowledge discovery.

Course Outcomes:

On successful completion of this course; the student shall be able to:

- Compare various conceptions of data mining as evidenced in both research and application.
- Characterize the various kinds of patterns that can be discovered by association rule mining.
- Evaluate mathematical methods underlying the effective application of data mining.
- Evaluation of Association Patterns and compact representation of frequent item sets.

Course Outcomes:

UNIT I Introduction to Data Mining **10 Hours**

Introduction to Data mining – Getting to Know about the Data. **Data Pre-processing:** An Overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization.

UNIT II Classification **10 Hours**

Basic Concepts – Decision Tree Induction – Bayes Classification Methods- Rule Based Classification – Techniques to Improve Classification Accuracy. Advanced Methods: Classification by Back Propagation - Support Vector Machines – k- NN Classifiers.

UNIT III Clustering **10 Hours**

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis - Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods. **Advanced Cluster Analysis:** Probabilistic Model-Based Clustering – Clustering High- Dimensional Data – Clustering with Constraints – Outlier Analysis.

UNIT IV Association Analysis **10 Hours**

Basic Concepts and algorithms : Problem Definition – Frequent Itemset Generation –Rule Generation –Compact representation of Frequent itemsets – Alternative methods for generating Frequent Itemsets- FP- growth Algorithm –Evaluation of Association Patterns.

Text Books:

1. Jiawei Han and Micheline Kamber, “Data Mining - Concepts and Techniques”, Third

Edition, Elsevier, 2012.(UNIT-I, II & III)

2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison Wesley, 2006.(UNIT-IV)

Reference Books:

1. Daniel. T. Larose Knowledge discovery, An Introduction to Data Mining, Wiley Publishers, 2014
2. Margaret H.Dunham, "Data mining introductory and advanced topics", Pearson education, 2003.
3. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

M20MS1040	Advanced Computer Networks	L	T	P	C
Duration : 52 Hrs		4	0	0	4

Course Description

This course covers a set of advanced topics in computer networks. The focus is on principles, architectures, and protocols used in modern networked systems, such as the Internet itself, wireless and mobile networks and high performance networks. The Internet protocols have revolutionized communications. This advanced networking course will equip you with a deep knowledge of network concepts, protocol design, and performance analysis that make the Internet work, help you develop critical insight into their design, and obtain a firsthand feel for implementation through homework and project exercises. Another key goal is to prepare you for doing research in the field of networking.

Prerequisites:

Computer Network Basics

Course Objectives:

The objectives of this course are:

- Make students build an understanding of the fundamental concepts of computer networking;
- Make students to become Familiar with the basic taxonomy and terminology of the computer networking area;

- Introduce the students to advanced networking concepts, preparing the student for entry Advanced courses in computer networking;
- Allow the students to gain expertise in some specific areas of networking such as the design and mainten aneof individual networks.

Course Outcomes:

On completion of this course the student will be able to:

- Understand and explain Data Communications System and its components;
- Enumerate the layers of the OSI model and TCP/IP and apply the function(s) of each layer on network applications;
- Identify the different types of network devices and their functions within a network and identify the new protocols for the same;
- Illustrate of environmental parameters measurement and become familiar with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Course Contents:

UNIT I Computer Networks and the Internet **13 Hours**

What Is theInternet? NetworkEdge; NetworkCore; Delay, Loss, and Throughput in Packet-Switched Networks; Protocol Layers and Their Service Models

Application Layer: Principles of Network Applications; Web and HTTP; File Transfer: FTP; Electronic Mail in the Internet; DNS—The Internet's Directory Service; Peer-to-Peer Applications; Socket Programming: Creating Network Application.

UNIT II Transport Layer **13 Hours**

Introduction and Transport-Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Principles of Reliable Data Transfer; Connection-Oriented Transport: TCP; Principles of Congestion Control; TCP Congestion Control

The Network Layer: Introduction; Virtual Circuit and Datagram Networks; what's Inside a Router? The Internet Protocol (IP): Forwarding and Addressing in the Internet; Routing Algorithms; Routing

in the Internet; Broadcast and Multicast Routing.

UNIT III The LinkLayer: Links, Access Networks, and LANs 13 Hours

Introduction to the Link Layer; Error-Detection and -Correction Techniques; Multiple Access Links and Protocols; Switched Local Area Networks; Link Virtualization: A Network as a Link Layer; Data Center Networking

Wireless and Mobile Networks

Introduction; Wireless Links and Network Characteristics; WiFi: 802.11 Wireless LANs; Cellular Internet Access; Mobility Management: Principles; Mobile IP; Managing Mobility in Cellular Networks; Wireless and Mobility: Impact on Higher-Layer Protocols

UNIT IV Security in Computer Networks 13 Hours

What Is Network Security? Principles of Cryptography; Message Integrity and Digital Signatures; End-Point Authentication; Securing E-Mail; Securing TCP Connections: SSL; Network-Layer Security: IPsec and Virtual Private Networks; Operational Security: Firewalls and Intrusion Detection Systems

Network Management: What Is Network Management? The Infrastructure for Network Management; The Internet-Standard Management Framework

Text Books:

1. James F. Kurose and Keith W.Ross, Computer Networking: A Top- Down Approach,. Addison- Wesley,6/E edition,2013. (Ch 1 to 8)

Reference Books

1. Nader F.Mir, Computer and Communication Networks, Pearson Education, 2007.
2. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, Tata Mc GrawHill, 2007.
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall, 5th edition, 2011.
4. Larry L Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann, 5th edition, 2011.

M20MS1050	Probability and Statistics	L	T	P	C
Duration : 52 hrs		4	0	0	4

Course Description

This course provides an introduction to the basic concepts and techniques of statistics and probability theory, random variables and develops problem solving skills with both theoretical and practical problems. Probability theory is the branch of mathematics that deals with modeling uncertainty. It is important because of its direct application in all areas. It also forms the fundamental basis for many other areas in the mathematical sciences including modern optimization methods and risk modeling.

Prerequisites:

Basic mathematics

Course Objectives:

The objectives of this course are to:

- Know the different Sampling Techniques used in Big data and related areas
- Introduce Random variables and Probability distributions.
- Learn the statistical procedures most often used by practicing engineers.
- Understand apply for business applications.

Course Outcomes:

On successful completion of this course; the student will be able to:

- Classify variables as quantitative or categorical, create appropriate numerical and graphical summaries for each type, and use these to explain/identify relationships between variables.
- Understand, apply and examine the goodness-of-fit test, test for independence, and coefficient of correlation for bivariate data.
- Illustrate and apply the concepts of discrete and continuous random variables, the discrete and continuous probability distributions and the joint probability distributions and solve real world problems in appropriate contexts by using standard techniques.
- Recognize and compute the single and multi-sample tests for m descriptive and inferential statistics in many different fieldsstatistics in many different fields

Course Content:

UNIT I **13 Hours**

Descriptive Statistics

Introduction meaning and scope of Statistics - Data classification, Tabulation, Frequency and Graphic representation - Measures of central Tendency - Arithmetic mean, Mode, Partition Values - Median, Quartiles, Deciles, Percentile - Measures of Dispersion – Range, Quartile deviation, Mean deviation, standard deviation, coefficient of Variance, Measure of Skewness, Moments & Kurtosis.

UNIT II **13 Hours**

PREDICTIVE ANALYTICS

Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, multiple correlation, least square, Curve fitting and goodness of fit.

UNIT III **13 Hours**

RANDOM VARIABLE AND PROBABILITY DISTRIBUTION

Introduction probability and its property, Random variable, its types DRV, CRV and its distributions, two dimensional R V, joint probability function, marginal density function. Some special probability distribution - Binomial, Poison, Uniform, Exponential and Normal Distribution.

UNIT IV **13 Hours**

HYPOTHESIS TESTING

Introduction Sampling, Sampling distribution, one and two tailed test, Test of significance, (mean, difference of means), confidence interval 1% and 5% level of significance - Design of Experiments, one way classification, two way classification, ANOVA.

Text Books:

1. Gupta. S.C and Kapoor V.K. Fundamentals of Mathematical Statistics 10 edition , Sultan Chand and sons, 2010
2. Larsen, Richard J., and Morris L. Marx. An introduction to mathematical statistics and its applications. Vol. 5. Pearson, 2017.

Reference Books:

1. Berenson and Levine, Basic Business Statistics, Prentice- Hall India (1996, 6thedition)
2. S.P.Gupta, “Statistical methods”- Sultan Chand & Sons, New Delhi, 2012 Edition
3. Ross Sheldon, A First Course in Probability, Macmillan , (6th edition)
4. Medhi.J, “Statistical methods - An introductory text”, new age publications, 2009 edition.

5. D.C. Montogomery and G.C.Runger, “Applied Statistics and Probability for engineers”, New Jersey,John Wiley and Sons, 3rd edition, 2003.
6. P K Srimani and M Vinayaka Murthy, “Probability and Statistics”, Subhas Stores, 2000
7. W.N. Venables, D.M Smith, “An introduction to R”
8. S M Ross, “Introduction to Probability and Statistics for Engineers and Scientists”, Academic Foundation, 2011
9. http://cran.r-project.org/doc/manuals/R-intro.html

M20MS1061	Advanced Operating Systems using Linux	L	T	P	C
Duration : 40 Hrs		2	0	1	3

Course Description:

This course deals with advances in the state-of-art operating system such as threads, SMP, Micro kernel and Virtual memory concepts. It also gives insight into multi-processor operating systems, distributed operating systems, multimedia operating systems, embedded and network OS.

Course Prerequisites:

Operating Systems & Unix

Course Objectives:

The objectives of this course are to:

- Introduce the overview of operating system, process description and its control.
- Study Threads, SMP, and micro kernel and virtual memory concepts.
- Provide systematic and comprehensive treatment of operating system;
- Provide a strong foundation in distributed resource management components .viz .the algorithms for implementation of distributed shared memory, recovery and commit protocols;

Course Outcomes:

On completion of this course the student will be able to:

- Demonstrate a fundamental knowledge of Windows, Linux,Unix,TinyOS,description and its control.

- Impart the knowledge about Threads, SMP, micro kernel and virtual memory concepts.
- Demonstrate a fundamental knowledge of the various resource management techniques for distributedsystems;
- Gain expertise in the security and kernel organization

Course Contents:

UNIT I Multiple Processor Systems **10 Hours**

MULTIPROCESSORS :Definition, Advantages, Classification, Multiprocessor Interconnections, Types of Multiprocessor OperatingSystems , Multiprocessor OS Functions and Requirements, OS Design and Implementing Issues,Multicomputer,Virtualization,Multiprocessor Scheduling.

UNIT II Distributed OperatingSystem **10 Hours**

Definition, Need, Models of Distributed Systems, Distributed Message Passing, Remote Procedure calls, Algorithms for Distributed Processing

UNIT III Multimedia Operating Systems **10 Hours**

Introduction to Multimedia; Multimedia files: Video Encoding, Audio Encoding; Video compression: The JPEG Standard, The MPEG Standard; Audio compression; Multi-media process Scheduling.

UNIT IV Embedded System & Network Operating System **10 Hours**

Embedded System: Definition, Need, Characteristics, Types of Embedded OS- Tiny OS; Network OS: Definition, Features of NOS, Types Of NOS, Windows Server VS Linux Server.

Text books:

1. "ModernOperatingSystem"ByAndrewSTanenbaum,3rded (chapter 7, 8)
2. Tanenbaum, Andrew S. Distributed operating systems. Pearson Education India, 1995. (chap 1, 2)

M20MS1062	Advanced DBMS	L	T	P	C
Duration: 40 Hrs		2	0	1	3

Course Descriptions:

This course is intended to provide with an understanding of the Advanced topics of DBMS such as Indexing, storage and emerging technologies in the field of database; query processing and optimization; advanced indexing techniques, Query evaluation, new database applications. This course helps to fully understand and appreciate the principle behind and gives a solid technical overview of how it works.

Course Prerequisites:

Basic DBMS concept

Course Objectives:

The objectives of this course are to:

- learn the modeling and design of databases
- acquire knowledge on parallel and distributed databases and its applications
- study the usage and applications of Object Oriented database
- understand the usage of advanced data models
- acquire inquisitive attitude towards research topics in databases

Course Outcomes:

On completion of the course, learners will be able to:

- Select the appropriate high performance database like parallel and distributed database
- Design a semantic based database to meaningful data access
- Embed the rule set in the database to implement intelligent databases
- Represent the data using XML database for better interoperability

Course Content:

UNIT I Overview of Storage and Indexing **10 Hours**

Memory hierarchy: RAID; Disk space management; Buffer manager: Files of records; Page formats and record format, Structured Indexing,, Data on external storage; File organizations and Indexing, Index data structures; Comparison of file organizations; Indexes and performance tuning. Intuition for tree indexes; Indexed sequential access method; B+trees , Hash-Based Indexing.

UNIT II Overview of Query Evaluation, External Sorting and Relational Query Optimizer

10 Hours

The system catalog, Introduction to operator evaluation; Algorithm for relational operations; Introduction to query optimization; When does a DBMS sort data? A simple two-way merge sort; External merge sort, Evaluating Relational Operators The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering.

UNIT III Concurrency Control **10 Hours**

Serializability and Transaction processing: Enforcing, Serializability by Locks, Locking Systems With Several, Lock Modes, Architecture for a Locking Scheduler Managing . **Transaction processing**: Introduction of transaction processing, advantages and disadvantages of transaction processing system, online transaction processing system, resolving deadlock, Transaction management in multi-database system, long duration transaction, high-performance transaction system.

UNIT IV Parallel and Distributed Databases and XML data **10 Hours**

Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Information retrival and XML data: Colliding Worlds: Databases, IR, and XML, Introduction to Information Retrieval, Indexing for Text Search, Web Search Engines, Managing Text in a DBMS, A Data Model for XML, XQuery: Querying XML Data.

Mobile databases, Multimedia databases, geographic databases, temporal databases, biological databases

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003[Chapters:8,9,10,11,12,13,14,22,23,27,29]

Reference Books:

1. Michael Rosenblum and Dr. Paul Dorsey," PL/SQL FOR DUMMIES",WILLEY Publications 2006
2. Elmasri and Navathe: Fundamentals of Database Systems,5th Edition, Pearson Education, 2007
3. Conolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.
4. Steven Feuerstein,"oracle PL/SQL Programming",OREILLYpublications,Sixth edition 2014.

M20MS1063	**Advanced Web Technologies**	**L**	**T**	**P**	**C**
Duration :40 Hrs		**2**	**0**	**1**	**3**

Course Description

The course provides a deep knowledge on PHP programming skills needed to successfully build interactive, data-driven web sites. Also, it introduces the core concepts of the Semantic Web that promises to dramatically improve the current World Wide Web (WWW) and its use. The SemanticWeb technology aims at removing main obstacles which prevent Web users from better support because the meaning of Web content is not machine-accessible.

Prerequisites:

Basic web technology

Course Objectives:

The objectives of this course are to:

- Introduce server-side Web technologies
- Impart knowledge about the concepts, design and basic coding of advanced Web applications such as ASP, Perl, CGI and other server side technologies
- Explain multimedia web; integrating basic database functions;
- Enable students to publish to multiple servers, XML, XSLT, SHTML, and Cascading Style Sheets may be utilized.

Course Outcomes:

On completion of this course the student will be able to:

- Understanding the basic coding of advanced Web applications such as ASP, Perl, CGI and other server side technologies
- Learn and apply different web technologies: XML, DTD, XSLT, Xpath,, JavaScript, JSP and Servlets
- Design and develop the real time web applications using PHP/MySQL
- Understanding basics of Ruby , SOAP and JSON technologies

Course Content:

UNIT I **10 Hours**

Programming in Perl: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output, Examples. CGI Scripting, Developing CGI Applications, Processing CGI, CGI.pm, CGI.pm methods, An Example, Adding Robustness, Carp, Cookies.

UNIT II **10 Hours**

Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling,

Files, Building Web applications with PHP Tracking users, cookies, sessions, Using Databases, Handling XML.

UNIT III **10 Hours**

Introduction to RUBY: Origins and uses of Ruby ,Scalar types and their operations ,Simple input and output, Control statements, Arrays, Hashes ,Methods, Classes, Code blocks and iterators ,Pattern matching ,Overview of Rails ,Document requests, processing forms , Rails applications with Databases, Layouts.

UNIT IV **10 Hours**

Web Services : Web 2.0 and 3.0 ,Software as a Service (SaaS) ,Rich user experience, Social Networking .SOAP ,RPC style SOAP , Document style SOAP ,WSDL ,REST services, JSON format ,WAP Architecture – WAP stack. Online Applications and emerging technologies – Online Shopping – Online databases – Monitoring user event..

Textbooks:

1. Robert W. Sebesta, Programming the World Wide Web, Pearson Education 2008. [chapter 8,9,11]
2. Chris Bates: Web Programming Building Internet Applications 3rd edition Willey india 2009[chapter 10,11,13]

Reference Books:

1. Roy, Uttam K. Web Technologies. Oxford University Press, 2010.
2. Holzner, Steven. PHP: the complete reference. Tata McGraw-Hill Education, 2007

M20MS1070	JAVA Lab	L	T	P	C
Duration: 26 Hrs		0	0	2	2

Course Objectives:

The objectives of this course are to:

- Understand fundamentals of object-oriented programming in Java Programming, including defining Classes, invoking methods, using class libraries, exception handling etc.
- Solve Programming problems using object-oriented paradigm
- Develop applications using threads and applet programming.
- Understand Java Database Connectivity with Programming

Course Outcomes:

On successful completion of this course; the student will be able to:

- Implement Java classes from specifications.
- Effectively create and use objects from predefined class libraries with Programming.
- Use interfaces, inheritance, and polymorphism as programming techniques.
- Use applets and GUI based controls

Lab Experiments

I. Basic programs

1) Write java program to print Biggest of 3 Numbers using Command line arguments.

2) Write a java program to print Factorial of a given number.

3) Write a java program to print sum of Sum of Digits and check for palindrome.

4) Write a java program to print the names in sorted order using arrays.

5) Write a java program to compute matrix multiplication using arrays.

II. Method Overloading

6) Write a java program to demonstrate method overloading to add two integers, add two strings.

III. Constructor overloading

7) Write a java program for Rectangle class using constructor overloading with different number of parameter list.

IV.Inheritance& Abstract class

8) Write a java program to demonstrate i. Simple Inheritance ii. multilevel inheritance.

V.Method Overriding

10) Write a java program to demonstrate Method overriding (use super keyword)

VI) Packages

11). Write a Java program to demonstrate user defined packages.

VII) Multiple Inheritance: Interface

12) Write a Java program to illustrate the multiple inheritance by using i. single Interface ii. Multiple interfaces iii. Inherited interface.

VIII) Super, Static, final keywords

13) Write a java program to illustrate the keywords i)super ii)static iii)final

IX) Exception handling

14) Write a java program to demonstrate exception handling with i. single catch block ii. multiple catch blocks

X) Multithreading

15) Write a Java program to demonstrate the concept of Inter thread communication by Suitable example

16) Write a Program on MultiThreads using Thread Class.

M20MS1080	**Data Mining Lab**	**L**	**T**	**P**	**C**
Duration:26 Hrs		**0**	**0**	**2**	**2**

Course Objectives:

The objectives of this course are to:

- Learn data analysis techniques through Data Mining Programming.
- Understand Data mining techniques and algorithms with Programs.
- Comprehend the data mining environments and applications.
- Understand the process of Knowledge discovery program

Course Outcomes:

On successful completion of this course, the student will be able to:

- Compare various conceptions of data mining as evidenced in research, Programming and applications.
- Characterize the various kinds of patterns that can be discovered by association rule mining.
- Evaluate Programming methods underlying the effective application of data mining.

Lab Experiments

1. Build Data Warehouse and Explore WEKA.
2. Create data-set in .arff file format. Demonstration of preprocessing on WEKA data-set.
3. Demonstrate performing association rule mining on data sets(contact lenses.arff /supermarket using apriori algorithm.)
4. Demonstration of classification rule process on WEKA data-set using j48 algorithm.
5. Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.
6. Demonstrate performing clustering on data sets(data-set iris.arff using simple k-means).
7. Demonstrate performing Regression on data sets.
8. Write a program of Naive Bayesian classification using C.
9. Write a program of cluster analysis using simple k-means algorithm using any programming language.
10. Write a program of Apriori algorithm using any programming language.

SECOND SEMESTER

M20MS2010	Machine Learning using Python	L	T	P	C
Duration: 52 Hrs		4	0	0	4

Course Description:

Machine Learning is a key to develop intelligent systems and analyze data in science and engineering. It covers theoretical foundations as well as essential algorithms for supervised and unsupervised learning.It also covers semi-supervised learning techniques.

Prerequisites:

OOPs & Data Mining concepts

Course Objectives:

The objective of this course are to

- Describe the basic components of Machine Learning with concepts of Python.
- Differentiate broad categories of Machine learning.
- Compare different types of algorithms used in Machine Learning domain with limitations.
- Examine the limitations of various machine learning algorithms and the way to evaluate performance of machine learning algorithms

Course Outcomes:

On successful completion of this course; the student will be able to:

- Explain concepts and theories of Machine Learning
- Formulate innovative ideas or techniques of machine learning for the real world problems
- Apply Machine Learning algorithms for specific problems.
- Understand the challenges and issues related to machine learning application areas.

Course Content:

UNIT I **13 Hours**

Python: Origin, Programming Basics, data types and Operators, Program Files, Directories, Changing Data Through Names, Copying Data, Accessing a Tuple Through Another Tuple, packages and libraries.Overview of ML, broad categories of Machine learning- Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning, Applications areas of Machine Learning. Examples and Case studies

UNIT II **13 Hours**

Supervised Learning: Introduction, Classification and Linear Regression, k-Nearest Neighbor, Linear models, Decision Trees, Naive Bayes Classifiers, KernelizedSupport Vector Machine (SVM) Algorithm.Neural Networks (deep learning), Comparison of different algorithms, discussions on case studies.

UNIT III **13 Hours**

Unsupervised Learning: Introduction, types and challenges, preprocessing and scaling of datasets, Dimensionality reduction, feature extraction. Principal Component Analysis (PCA), k-means, agglomerative, and DBSCAN clustering algorithms. Comparison of different cluster algorithms, discussions on Case studies

UNIT IV **13 Hours**

Semi-supervised: Introduction, discussion on Generative models and Graph-based methods. **Reinforcement:** Introduction, the learning task, Q learning –function, convergence, & updating sequence, rewards and actions, relationship to dynamic programming, discussions on Case studies

Text Books:

1. 1Introduction of Machine Learning with Python – by Andreas C Muller & Sarah Guidp – O'Reilly & Shroff publishers. Chapters 1, 2 and 3.
2. Introducing Python by Bill Lubanovic(chapters 1-6), Oriely Publications, 1st Edition
3. Python Programming for absolute beginners by Michael Dawson, Course Technology-A part of CENGAGE Learning, 3rd Edition
4. Machine Learning by Tom M Mitchell – McGraw Hill Education publication – 2013. Chapter 13.

Reference Books:

1 Machine Learning: The Art and Science of algorithms – by Peter Flach – Cambridge University Press. Chapter 12

2 Machine Learning - by EthemAlpaydin – PHI learning private limited. Chapter 1, 7, 16, 18, 19

3 Bayesian Reasoning and Machine Learning – by David barber - Cambridge University Press. Chapter 13, 15

4 Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006

5 Semi-Supervised Learning - by Olivier Chapelle, Bernhard Sch¨olkopf, and Alexander Zien - The MIT Press Cambridge

6 The Elements of Statistical Learning – by Trevor Hastie, Robert Tibshirani and Jerome Friedman – Springer 2017 publication

7 Python Programming for absolute beginners-3rd Edition by Michael Dawson.

M20MS2020	Linear Algebra	L	T	P	C
Duration : 52 Hrs		4	0	0	4

Course Description:

In this course students will study the concepts of Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets; Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation. The purpose of this course is to provide students with skills and knowledge required to perform mathematical procedures. This course is widely used in all streams of computer science particularly in the field of Computer Science and Applications.

Prerequisites:

Basic Maths

Course Objectives:

This course will:

- Recall basic concepts of matrices and matrix algebra.
- Present methods of solving systems of linear equations
- Demonstrate basic concepts of vector spaces
- Interpret the concepts of linear transformations by using the matrices
- Develop methods of computing and using eigen values and eigenvectors.

Course Outcomes:

On the successful completion of this course, Students shall be able to

- Solve the system of Linear Equations by using Matrix Algebra.
- Derive the Norms and Inner Product Spaces
- Summarize the vector space properties.
- Analyze different forms of the Linear Transformations.

Course Content:

UNIT I **13 Hours**

Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets; Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation, Composition of Linear Transformations, and Matrix Multiplication, Invertibility and Isomorphisms, The Change of Coordinate Matrix, The Dual Space; Elementary Matrix Operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations.

UNIT II **13 Hours**

Properties of Determinants, Cofactor Expansions, Elementary Operations and Cramer's Rule; Eigenvalues and Eigenvectors, Diagonalizability, Invariant Subspaces and the Cayley-Hamilton Theorem; Inner Products and Norms, (No theorem proof).

UNIT III **13 Hours**

The Adjoint of a Linear Operator, Normal and Self-Adjoint Operators, UNITary and Orthogonal Operators and Their Matrices, Orthogonal Projections and the Spectral Theorem; Bilinear and Quadratic Forms (No theorem proof).

UNIT IV **13 Hours**

The Diagonal form, The Triangular form; The Jordan Canonical Form; The Minimal Polynomial; The Rational Canonical Form (No theorem proof).

Text Books:

1. S. Friedberg, A. Insel, and L. Spence - Linear Algebra, Fourth Edition, PHI, 2009.
2. Jimmie Gilbert and Linda Gilbert – Linear Algebra and Matrix Theory, Academic Press, An imprint of Elsevier.
3. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.
4. Hoffman and Kunze – Linear Algebra, Prentice-Hall of India, 1978, 2nd Ed.,
5. P. R. Halmos – Finite Dimensional Vector Space, D. Van Nostrand, 1958.
6. S. Kumeresan – Linear Algebra, A Geometric approach, Prentice Hall India, 2000.

M20MS2030	BigData with NoSQL	L	T	P	C
Duration: 52 Hrs		4	0	0	4

Course Description:

The course has been designed to give learners a very comprehensive understanding of Big Data and MongoDB. This will give a comprehensive look at the wide landscape of database systems and how to make a good choice in your next project. This course covers almost all classes of databases or data storage platform there are and when to consider using them. Students will learn how to design, build, launch, deploy, and scale an application using MongoDB with PHP.

Prerequisites:

Data Bases & Data mining concepts

Course Objectives:

The objectives of this course are to:

- Learn the latest trends in databases.
- Learn various NoSql systems and their features.
- Compare NoSql databases with each other and relational systems.
- Acquire knowledge in parallel, distributed databases and its applications.
- Learn emerging databases like MongoDB, Hbase.

Course Outcomes:

On completion of this course the student will be able to:

- Define, compare and use the four types of NoSQL Databases (Document oriented, Key Value Pairs, Column oriented and Graph).
- Analyze the need of NoSQL databases in handling Big data
- Compare the Difference between the types of NOSQL databases.
- Demonstrate the data models in these databases.

Course Content:

UNIT I Introduction toNOSQL **13 Hours**

Introduction to NoSQL Definition of NOSQL-Challenges in traditional RDBMS- Need for NOSQL-Big Data and NoSQL, Need for schema less databases. History of NOSQL. Aggregate data models, Distribution models, CAP theorem, Types of NOSQL Data bases- key-value Column store, document data models and Graph Data models. Scalability and NoSQL.

UNIT II Key-ValueStoresandColumnstores **13 Hours**

Introduction to Key-value stores- Exploring RedisRedis data model Storing Data in and Accessing Data from Apache Redis –Querying in Redis using examples Redis use cases. Introduction to Column stores- Exploring HBASE – HBASE data model Storing Data CRUD operations in HBASE.

UNIT III Documentstores and its applications **13 Hours**

Introduction to Document stores, Exploring MongoDB, MongoDB data model, Storing Data in and Accessing Data from MongoDB, Querying in MongoDB using examples, Interact with MongoDB

using any one Language Binding with PHP.

UNIT IV Big Data Handling and Graph Databases 13 Hours

Big Data processing with MongoDB, Import and Export commands in MongoDB, MongoDB Indexing. MongoDB DatabaseAdministration.

Graph Databases, Introduction,What Is a Graph-A High-Level View of the Graph Space, Performance, Graph Databases, Graph Compute Engines, The Power of Graph Databases,, Options for Storing Connected Data, Relational Databases Lack Relationships, NOSQL Databases Also Lack Relationships, Graph Databases Embrace Relationships.

Data Modeling with Graphs, Models and Goals, The Labeled Property Graph Model, Querying Graphs: An Introduction to Cypher, Cypher Philosophy, MATCH, RETURN, other Cypher clauses.

Text Books:

1. Pramod. J. Sadalge, Martin Fowler, NoSQL distilled, A brief guide to emerging world of Polyglot persistence. Addison-Wesley 2013.
2. Lars GeorgeHBase: A definitive Guide, OReilly publications,2011.
3. Josiah L. Carlson, Redis in Action,Manning Publications, 2013.
4. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress2010.
5. Ian Robinson, Jim Webber & Emil Eifrem, Graph Databases.

Reference Books:

1. "Professional NOSQL" by Shashank Tiwari, 2011, WROX Press.
2. Kristina Chodorow, MongoDB: The Definitive Guide, 2nd Edition, O'Reilly publications,2013.

Reference Websites

1. www.mongodb.org
2. www.redis.io
3. www.hbase.apache.org

UNITwise Text books reference

UNIT-I- R1- Chapter 1, T1-Chapter 1-4,5.3.1
UNIT-II- www.redis.io, www.hbase.apache.org
UNIT-III-T4-chapter 4,6
UNIT-IV-Chapter 9; T5-Chapter 1-3

M20MS2041	System Modeling and Simulation	L	T	P	C
Duration: 40 Hrs		2	1	0	3

Course Description:

This course covers modeling and simulation principles with applications to systems architecting and engineering. It covers modeling approaches with a focus on continuous and discrete simulation, and surveys applications for complex systems across a variety of engineering domains. Queuing systems. Continuous simulation, numerical methods. Simulation experiment control. Visualization and analysis of simulation results. Modeling methodologies require data generation/gathering, testing and verification, and analysis of result.

Prerequisites:

Probability & Statistics

Course Objectives:

The objectives of this course are to:

- Make the students to understand the importance simulation and modeling in a range of important application areas.
- Explain the event – scheduling, time-advance algorithm in computer networks
- Introduce discrete event stochastic models and queuing models.
- Learn the benefits of probability, random process verification and validation of the models.

Course Outcomes:

On successful completion of this course, the student is expected to be able to:

- Outline the various applications of simulation.
- Describe the role of important elements of simulation in modeling paradigm.
- Generate Random numbers using different techniques.

- Apply simulation on various layers for Optimization and random number generation and Present the Modeling techniques for event systems.

Course Content:

UNIT I Introduction **10 Hours**

Why is Simulation Important? When simulation is the appropriate tool and when it is not appropriate? Areas of application, Systems and system environment; Components of a system, Discrete and continuous systems, Model of a system; Types of Models; Discrete-EventSystem Simulation. Simulation examples: Simulation of queuing systems; Simulation of inventory systems:
other examples of simulation. What is model? Advantages and Disadvantages of Modeling and Simulation, Common Pitfalls of Modeling and Simulation and Rules of Thumb, Overview of M&S tools

UNIT II General Principal, Statistical &QueuingModels **10 Hours**

Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, WorldViews, Manual simulation Using Event scheduling; Listprocessing.

Review of terminology and concepts; Useful statistical models; discrete distributions; Continuous distributions; Poisson process; Empirical distributions. Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

UNIT III Random-Number **10 Hours**

Properties of random Numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for RandomNumbers; Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique;Special properties.

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of FitTests; Fittinganon-stationary Poisson process; selecting input models without data; Multivariate and Time-Series input models.

UNIT IV Verification and Validation of Simulation Models **10 Hours**

Model building, verification and validation; Verification of simulation models; Calibration and validationofmodels.OptimizationviaSimulation; Modeling and Simulation using Network Simulator: RF Propagation Wired MANE, Network Layer.

TextBooks:

1. Jerry Banks , John S. Carson II , Barry L. Nelson , David M. Nicol, ''Discrete-Event System Simulation'', Pearson Education, 5th edition, 2015 (chapters 1-10).
2. Averill M. Law, ''Simulation Modeling and Analysis'', Tata McGraw-Hill, 4th edition, 2007.(chapters 7, 8)
3. Wehrle, Klaus, Günes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", 2010.(chapters 1-5).

Reference Books:

1. Sheldon M Ross, "Simulation", Elsevier Publication, 5th Edition, 2014(chapters 4, 7, 8 and 11).

M20MS2042	Pattern Recognition	L	T	P	C
Duration: 40 Hrs		2	1	0	3

Course Descriptions:

Pattern recognition forms the basis of learning and action that is needed in the real world. It introduces the concept of machine perception, design cycle, learning and adaptation techniques. Normal density, Maximum likelihood and Bayesian parameter estimation models help to discriminate different patterns and classify the objects. The unsupervised learning and clustering concepts allows us to group the objects based on their similar behavior. Different patterns in speech signals can be identified and classified by means of Hidden Markov model.

Prerequisites:

Data Mining, Image Processing

Course Objectives:

The objectives of this course are to:

- Understand basic concepts in pattern recognition.
- Gain knowledge about state-of-the-art algorithms used in pattern recognition research

- Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
- Apply pattern recognition techniques in practical problems.

Course Outcomes:

On completion of this course the students will be able to:

- Understand basic concepts in pattern recognition.
- Gain knowledge about state-of-the-art algorithms used in pattern recognition research.
- Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
- Apply pattern recognition techniques in practical problems.

Course Content:

UNIT I Introduction **10 Hours**

Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation. Bayesian Decision Theory : Introduction, continuous features – two categories classifications, minimum error-rate classification- zero– one loss function, classifiers, discriminant functions, and decision surfaces

UNIT II Normal density **10 Hours**

Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context. Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case

UNIT III Un-supervised learning and clustering **10 Hours**

Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering

UNIT-IV Discrete Hidden Markov Models **10 Hours**

Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs. Continuous hidden Markov models: Observation densities, training and testing

with continuous HMMs, types of HMMs.

Text Books:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley student edition, Second Edition, 2001. {Chapters: 1, 2, 3, 10}
2. Fundamentals of speech Recognition, LawerenceRabiner, Biing – Hwang Juang Pearson education, 1993. {Chapters: 6}.

Reference Books:

1. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh, Steve Jost PHI 2004

M20MS2043	Human Computer Interaction	L	T	P	C
Duration :40 Hrs		2	1	0	3

Course Description:

This subject emphasis on design and evaluation of human computer interfaces using different frameworks and elements. It also provides the techniques to measure the usability and flexibility of softwares or applications.The subject covers the basics of human computer interaction, guidelines to design the websites and selection of colours, widgets,functional keys and and interaction devices.

Prerequisites:

System Design and Implementation

Course Objectives:

This Course will enable students to

- Describe what interaction design is and how it relates to human computer interaction and other fields
- Outline the Design rules and interaction with user.
- Identify some of the common pitfalls in data analysis, implementation issues and guidelines.
- Explain how to usability interaction takes and few cases studies

Course Outcomes:

Upon completion of the course, the student should be able to:

- Identify human factors and computer and devices issues related with computing applications
- Design a user interface by applying suitable design principles, models and usability guidelines
- To explore the Design rules, Support, Evaluation methods for HCI Patterns
- To identify the goals and measures of a system using various design patterns with help of case studies.

Course Contents:

UNIT I **10 Hours**

Introduction, The human: Introduction, Input–output channels, Human memory, Thinking: reasoning and problem solving , Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Introduction, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning Memory , Processing and networks;

UNIT II **10 Hours**

The interaction: Introduction, Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction, Experience, engagement and fun. Design Process-Interaction design basics, Introduction, What is design, The process of design, User focus, Scenarios. Navigation design, Screen design and layout, Iteration and prototyping HCI in the software process: Introduction, The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale.

UNIT II **10 Hours**

Design rules: Introduction, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Implementation support: Introduction, Elements of windowing systems,

Programming the application, Using toolkits, User interface management systems Evaluation techniques: What is evaluation?, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method.

UNIT IV **10 Hours**

Usability of Interactive Systems , Introduction, Usability Goals and Measures, Usability Motivations, Goals for Our Profession, Design , Introduction, Organizational Support for Design, The Design Process, Design Frameworks, Design Methods, Design Tools, Practices, and Patterns, Social Impact Analysis, Legal Issues, Design Case Studies , Case Study 1: Iterative Design Evaluation of Automated Teller Machines (ATMs), Case Study 2: Design Consistency at Apple Computer, Case Study 3: Data-Driven Design at Volvo, General Observations and Summary.

Text Books:

1. "Human Computer Interaction" by Alan Dix, Janet Finlay , ISBN :9788131717035, PearsonEducation (2004)(Unit 1,2,3- chapter 1,2,3,5,6,7,8,9)
2. "Designing the User Interface -Strategies for Effective Human Computer Interaction", by Ben Shneiderman, 6th edition ISBN : 9788131732557,Pearson Education (2010). (Unit 4- 1,4,6)

Reference Books:

1. Usability Engineering: Scenario-Based Development of Human-Computer Interaction, by Rosson, M. and Carroll, J. (2002)
2. The Essentials of Interaction Design,by Cooper, et al. , Wiley Publishing(2007)
3. Usability Engineering, by Nielsen, J. Morgan Kaufmann,San Francisco, 1993. ISBN 0-12-518406-9
4. The Resonant Interface: HCI Foundations for Interaction Design , byHeim, S. ,Addison-Wesley. (2007)
5. Usability engineering: scenario-based development of human-computer interaction,By Rosson, M.B & Carroll,J.M. , Morgan Kaufman.(2002).

M20MS2051	Software Project Management	L	T	P	C
Duration :40 Hrs		2	1	0	3

Course Description:

This course describes the key aspects of a software project management. It begins with the overview of project planning and elaborates software evaluation and costing. This course also includes those topics relevant to successful software development management, including organizing software.

Prerequisites:

System Analysis & Design, Software Engineering

Course Objectives:

The objectives of this course are to:

- To define the scope of Software Project Management.
- To understand the problems and concerns of software project managers.
- To learn the cost estimation techniques during the analysis of the project.
- To identify the stakeholders and their objectives.
- To apply the quality concepts for ensuring the functionality of the software project.

Course Outcomes:

On completion of the course, learners will be able to:

- Understand the software project planning, design and development process to relate the project with all other project management activities
- Identify, classify various types of risks and recognize the importance of project cost evaluation
- Implement the risk management techniques and the optimum resource allocation to develop quality projects
- Analyze and illustrate Agile Project Management using SCRUM to develop reliable software projects.

Course Content:

UNIT I Software Project Management (SPM) Concepts and project evaluation 10 Hours

Introduction to Software Project Management: Why software project important?, software project versus other types of projects; Activities covered by SPM; Plans, methods and methodologies; stakeholders, setting objectives.

An Overview of Project Planning: Introduction to step wise project planning (step 0 to step 9); Case Study: Project planning case study.

UNIT II Software Evaluation and Software Effort Estimation 10 Hours

Software Evaluation: Project Portfolio Management;Evaluation of individual projects, Cost-Benefit analysis techniques, Risk evaluation, Programme management, Managing he allocation of resources, Strategic program management.

Software Effort Estimation: Introduction, problems with over and under estimates, Software effort estimation techniques, Bottom-up Estimating, the Top-up approach and parametric models, Estimating by analogy, Alebrecht Function Point Analysis, COCOMO II: A Parametric Productivity Model.

Case study: Software Evaluation and Costing

UNIT III Risk Management, Recourse Allocation and Software Quality: 10 Hours

Risk Management: Introduction, risk, Categories of risk, Framework for dealing with risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to schedule.

Recourse Allocation: Introduction, The Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Counting The Cost, Publishing The Resources Schedule, Cost Schedules.

Software Quality: The Importance of Software Quality, Defining Software Quality, ISO 9126, Product and Process Metrics, Product versus Process Quality Management.

UNIT IV Agile Project Management using SCRUM 10 Hours

Introduction: Values, Principles, agile Manifesto, SCRUM Methodology: Roles and Responsibilities in Scrum, Implementing Scrum Process, Estimating Scrum Project, Challenges and Benefits of APM, Case Study: APM Using Scrum.

Text Books:

1. Bob Hughes & Mike Cotterell, an Rajib Mall - "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012. (UNIT01: Chapters 01, 03; UNIT02:

Chapters 02, 05; UNIT03: 07, 08 and 13ansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013).

2. Agile Project Management with Scrum (Developer best Practices) by Ken Schwaber, Microsoft press Publication.

Reference Books:

1. Richard H.Thayer "Software Engineering Project Management," IEEE Computer Society.
2. Futrell , "Quality Software Project Management", Pearson Education India
3. http://en.wikipedia.org/wiki/Comparison_of_project_management_software.
4. http://www.ogc.gov.uk/methods_prince_2.asp.
5. Project Management The Agile Way, Making it work in the Enterprise by John.C.Goodpasture, PMP Rose Publishing.

M20MS2052		CourseType	L	T	P	C
Duration : 40 Hrs	Social Network Analysis	SC	2	1	0	3

Course Description:

The course enables the students to learn limitations of current web, and the emergence of semantic & social networks. This course enables the student to understand different types of model used for knowledge representations in these networks. The course gives the idea of how we can adopt social networks for mining meaningful information in web/network. After completion of the course, the students learnt how the privacy of information has to be maintained to protect from online thefts.

Prerequisites:

Web programming and Networks

Course Objectives:

The objectives of this course are to:

- Understand the concept of semantic web and related applications.
- Learn knowledge representation using ontology.
- Understand human behaviour in social web and related commUNITies
- Learn visualization of social networks.

Course Outcomes:

On successful completion of this course; the student will be able to:

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related commUNITies.
- Visualize social networks.

Course Contents:

UNIT I **10 Hours**

Social Networks: Introduction, Research Issues & Topics in Social Networks. Statistical Properties of Social Networks: Definitions & Data description, Static Properties of Unweighted Graphs & Weighted Graphs, Dynamic Properties of dynamic Unweighted Graphs & dynamic Weighted Graphs

CommUNITy Discovery in Social Networks: Applications, Methods and Emerging Trends, CommUNITies in Context, Core Methods, Quality Functions, The Kernighan-Lin (KL), Agglomerative/Divisive, Spectral Algorithms, Multi-level Graph Partitioning, Markov Clustering, Other Approaches, CommUNITy Discovery in Dynamic Networks, Heterogeneous Networks, and Directed Networks.Coupling Content and Relationship Information for CommUNITy Discovery, Cross-cutting Issues.

UNIT II **10 Hours**

Node Classification in Social Networks: Introduction, Problem Formulation, Representing data as a graph, The Node Classification Problem, Methods using Local Classifiers Iterative Classification Method, RandomWalk based Methods, Label Propagation, Graph Regularization, Adsorption, Applying Node Classification to Large Social Networks, Basic Approaches, Second-order Methods, Implementation within Map-Reduce.

Evolution in Social Networks: Introduction, Framework, Modeling a Network across the Time Axis, Evolution across Four Dimensions, Challenges of Social Network Streams.

Models and Algorithms for Social Influence Analysis: Introduction, Influence Related Statistics, Edge and Node Measures, Social Similarity and Influence, Homophily, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization,

UNIT III **10 Hours**

Expert Locations in Social Networks: Definitions and Notation, Expert Location without Graph Constraints, Language Models for Expert Location, Expert Location with Score Propagation, PageRank Algorithm, HITS Algorithm, Expert Score Propagation, Expert Team Formation, Metrics, Forming Teams of Experts, Agent-based Approach, Influence Maximization, Expert Location Systems.

Link Prediction in Social Networks:

Introduction, Background, Feature based Link Prediction, Feature Set Construction, Classification Models, Bayesian Probabilistic Models, Link Prediction by Local Probabilistic Models, Network Evolution based Probabilistic Model, Hierarchical Probabilistic Model, Probabilistic Relational Models, Relational Bayesian Network, Relational Markov Network. Linear Algebraic Methods

Privacy in Social Networks: Introduction, Privacy breaches in social networks, Identity disclosure, Attribute disclosure, Social link disclosure, Affiliation link disclosure, Privacy definitions for publishing data, k-anonymity, l-diversity and t-closeness, Differential privacy, Privacy-preserving mechanisms, for social networks, affiliation networks.

UNIT IV **10 Hours**

Data Mining in Social Media: Motivations, Data Mining Methods for Social Media, Data Representation, Data Mining - A Process, Social Networking Sites - Illustrative Example, The Blogosphere: Illustrative Examples, Related Efforts, Ethnography and Netnography, Event Maps

Text Mining in Social Networks: Introduction, Keyword Search, Query Semantics and Answer Ranking, Keyword search over XML and relational data, Keyword search over graph data, Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogeneous Networks, case study on any one of social media network

Text Books:

1. Social Network Data Analytics – by Charu C. Aggarwal, Springer 2011
2. Scott, J., & Carrington, P. J. (Eds.). (2011). The SAGE Handbook of Social Network Analysis. London; Thousand Oaks, Calif: SAGE Publications Ltd.
3. Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). Analyzing social networks. Los Angeles; London: SAGE Publications.

Reference books:

1. D. Easley, J. Kleinberg. Networks, Crowds and Markets: Reasoning About a Highly Connected World. Cambridge University Press, 2010.

2. M. E. J. Newman. Networks: An Introduction. Oxford University Press, 2010.

3. W. de Nooy, A. Mrvar, V. Batagelj. Exploratory Social Network Analysis with Pajek. Cambridge University Press, 2005.

4. Shamanth Kumar, Fred Morstatter, Huan Liu. Twitter Data Analytics. Springer-Verlag New York, 2014.

5. Wasserman, S., & Faust, K. (1994). Social Network Analysis: Methods and Applications. New k: Cambridge University Press.

M20MS2053	Business Intelligence	CourseType	L	T	P	C
Duration : 40 Hrs		SC	2	1	0	3

Course Description:

The course describes about the business intelligences and its strategies how to make the decision in business. It also includes the methods i.e data mining techniques like classification, clustering, various business intelligence methods, Decisions support system and architecture. Evaluation of the results and applications.

Prerequisites:

Data Mining, Data Analysis

Course Objectives:

The objectives of this course are to:

- Outline different decision making components in business intelligence system.
- Examine modeling and decision support system.
- Demonstrate business intelligence life cycle and the techniques used in it
- Evaluate data analysis tools and techniques.

Course Outcomes:

On successful completion of this course; the student will be able to:

- Analyze and Understand the role of decision models and explore solutions of BI(level-1,4)
- To understand and apply the mathematical models of Decisions making ·
- Provide solutions to real life problems using classification techniques and clustering algorithms and evaluate the methodologies. ·
- Identify decision process using Software tools and intelligence for indivial applications

Course Content:

UNIT I

Components of decision making process **10 Hours**

Business Intelligence: Effective and timely decisions-Data, information and knowledge-The role of mathematical models-Business intelligence architecture-Ethics and business intelligence.

Decision support system: Definition of system-representation of the decision making process-Evolution of information system- Definition of decision support system-development of decision support system.

UNIT II **10 Hours**

Mathematical model for decision making: Structure of mathematical models-Development of model-classes of models. Regression: Structure of regression models-simple linear regression-multiple linear regression. Time series: Definition of time series-Evaluating time series models-Analysis of the component of time series.

UNIT III **10 Hours**

Classification: Classification problems-Taxonomy of classification models-Evaluation of classification models. Association rules: Motivation and structure of association rules-single dimension association rules-general association rules. Clustering: Clustering Methods-partition method-hierarchical methods-evaluating of clustering models.

UNIT IV **10 Hours**

Business intelligence Applications: Marketing models-Sales force management-Decision process in sales forces management. Business Case studies: Retention in telecommunications-acquisition in the automotive industry-Cross selling in the retail industry.

Text Books:

1. Carlo Vercellis, "Business Intelligence", Wiley publications,2015 (Chapter 1 &2, Chapter 4,8 &9, Chapter 10,11 &12, Chapter 13),

Reference Books:

1. GalitShmueli, Nitin R. Patel, Peter C Bruce, "Data Mining for Business Intelligence, Wiley publications, 2014
2. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.

M20MS2061	Mobile Computing and APP store Management	CourseType	L	T	P	C
Duration : 40 Hrs		SC	2	1	0	3

Course Description:

This course will help you gain adequate knowledge on the Wireless Technologies, potential of the Internet of Things based Mobile Computing for our society, in terms of impact on the lives of billions of people and on the world economy.

Prerequisites:

Computer Networks, IOT etc.

Course Objectives:

The objectives of this course are to:

- Impart basic understanding of the wireless communication systems.
- Expose students to various aspects of mobile computing techniques.

- Understand the basic concepts of mobile computing.
- Be familiar with the network protocol stack
- Gain knowledge about different mobile platforms and application development.

Course Outcomes:

On completion of the course, learners will be able to:

- Impart basic understanding of the wireless communication systems.
- Expose students to various aspects of mobile computing techniques.
- Understand the basic concepts of mobile computing.
- Be familiar with the network protocol stack and Gaining knowledge about different mobile platforms and application development

Course Contents:

UNIT I Mobile Computing Application and Services 10 Hours

Introduction to mobile computing, Middleware and Gateways, Application and services, Internet-Ubiquitous networks, Architecture and three-tier architecture for Mobile Computing, Design consideration for Mobile Computing. Spread spectrum – Direct sequence, Frequency hoping. Medium Access Control - SDMA, FDMA, TDMA, CDMA, Cellular concepts- channel assignment strategy- hand off strategy interface and system capacity- improving coverage and capacity in cellular system, Satellite Systems-GEO, LEO, MEO. Wireless Communication Systems- Telecommunication Systems- GSM- GSM services & features, architecture -DECT features & characteristics, architecture.

UNIT II Mobile Computing Architecture 10 Hours

Wireless LANS: Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, Cellular Networks: Channel allocation, multiple access, location management, Handoffs. MAC Layer & Management, Routing - Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

UNIT III Introduction to Android **10 Hours**

Introduction to Android Architecture: Introduction, History, Features and Android Architecture. Android Application Environment, SDK, Tools: Application Environment and Tools, Android SDK. Programming paradigms and Application Components - Part 1: Application Components, Activity, Manifest File, Programming paradigms and Application Components

UNIT IV User Interface Design **10 Hours**

User Interface Design part 1: Views &View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design part 2: Menus, Action Bars, Notifications : Status, Toasts and Dialogs, Styles and Themes, Creating Custom Widgets, Focus, Touch Mode, Screen Orientation.

Text Books

1. Asoke K. Talukder, Hasan Ahmad, Mobile Computing Technology- Application and Service Creation, 2nd Edition, McGraw Hill Education. (chapter 1 & 2)

2. Professional Android 4 Development by Reto Meier, John Wiley and Sons, 2012 .(Chapter 1, 2,3)

Reference Books:

1. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.

2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015.

3. J F DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580 4. Anubhav Pradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2

4. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.

M20MS2062	Service Oriented Architecture	CourseType	L	T	P	C
Duration : 40 Hrs		SC	2	1	0	3

Course Description:

This course focuses on service-oriented architectural model and the service-orientation design paradigm. It will describe Service Oriented Architecture (SOA) concepts and principles, as well as quality considerations for developing modern software systems from a technical and organizational perspective. Specifically, the course will cover principles of SOA design and SOA design patterns. Furthermore, as SOA involves more than technology, additional topics will include the impact of SOA on culture, organization, and governance. The aim of this course is to establish a strong understanding of the concepts needed to have an effective working knowledge of SOA methodologies, and SOA systems design.

Prerequisites:

Application Integration, Management, reusability

Course Objectives:

The objectives of this course are to:

- gain understanding of the basic principles of service orientation
- Learn service oriented analysis techniques
- Analyse technology underlying the service design
- Understand the concepts such as SOAP, registering and discovering services.

Course Outcomes:

On successful completion of this course; the student will be able to:

- Get the foundations and concepts of service based computing
- Advocate the importance and means of technology alignment with business
- Understanding the basic operational model of web services,
- Gain the knowledge of key technologies in the service oriented computing arena

- Apply and practice the learning through a real or illustrative project/case study s

Course Contents:

UNIT I **10 Hours**

Service-Oriented Computing and SOA: Fundamental SOA, Common characteristics of contemporary SOA, Common misperceptions about SOA, Common tangible benefits of using SOA, Common pitfalls of adopting SOA.

UNIT II **10 Hours**

Service-Orientation: Introduction to Service-Orientation, Problems Solved by Service-Orientation, Challenges Introduced by Service-Orientation, Effects of Service-Orientation on the Enterprise, Origins and Influences of Service-Orientation

UNIT III **10 Hours**

Analysis: Service oriented analysis ,Business-centric SOA , Deriving business services- service modeling ,Service Oriented Design , WSDL basics , SOAP basics , SOA composition guidelines, Entity-centric business service design ,Application service design , Task centric business service design

UNIT IV **10 Hours**

Understanding Design Principles:Using Design Principles, Principle Profiles, Design Pattern References, Principles that Implement vs. Principles that Regulate, Principles and Service Implementation Mediums, Principles and Service Contract Granularity.

Text Books:

1. Erl, Thomas, Paulo Merson, and Roger Stoffers. Service-Oriented Architecture: Analysis and Design for Services and Microservices. Prentice Hall, 2017. (chap 3, 4, 5)

2. Service-Oriented Architecture: Concepts, Technology, and Design, Thomas Erl, Pearson Education, 2005 (chap 3, 4)

Reference Book:

1. Hentrich, Carsten, and Uwe Zdun. Process-Driven SOA: Patterns for Aligning Business and IT. Auerbach Publications, 2016.

M20MS2063	Internet of Things	CourseType	L	T	P	C
Duration : 40 Hrs		SC	2	1	0	3

Course Objectives:

Internet of Things as a buzzword has caught the attention of all of us. This course will help you gain adequate knowledge on the Internet of Things. Understand the potential of the Internet of Things for our society, in terms of impact on the lives of billions of people and on the world economy. Understand the underlying technology that powers the Internet of Things, as well as the challenges that comes with such technologies. Will explore many real-life examples of IoT devices that are commercially available, and you will have a glimpse of the future of the Internet of Things. Advanced topics will cover a selection of modern algorithms, many of which come from real-world applications.

Prerequisites:

Networking, Algorithms and Coding skills

Course Objectives:

The objectives of this course are to:

- Discuss the basics of Internet of Things
- Identify different IoT applications and their application areas.
- Explain the emerging field of wireless sensor networks and IoT, which consist of many tiny, low-power devices equipped with sensing, computation, and wireless communication capabilities.
- Describe operating systems, radio communication, networking protocols, Methodologies of IoT

Course Outcomes:

On successful completion of this course; the student will be able to:

- Understand and analyze the usability of the IoTs across various real-world applications

- Analyze low-power devices equipped with sensing, computation, and wireless communication capabilities along with M2M communication.
- Illustrate of environmental parameters measurement and monitoring by exposing participants to the comprehensive fundamentals of Smart Sensors and Internet of Things
- Understand the operating systems, radio communication, networking protocols and develop application with a programming language.

Course Content:

UNIT I Introduction to Internet of Things **10 Hours**

Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, RFID Basics, Embedded Systems, IoT Levels & Deployment Templates.

UNIT II IoT and M2M **10 Hours**

Introduction; M2M, Difference between IoT and M2M , SDN and NFV for IoT , Software Defined Networking , Network Function Virtualization , IoT System Management with NETCONF-YANG, Need for IoT Systems Management, Simple Network Management Protocol (SNMP) , Limitations of SNMP , Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

UNIT III Developing Internet Of Things **10 Hours**

IoT Design Methodology, Step 1: Purpose & Requirements Specification, Step 2: Process Specification, Step3: Domain Model Specification, Step4: Information Model Specification, Step 5: Service Specifications, Step6: IoT Level Specification, Step7: Functional View Specification, Step8: Operational View Specification, Step9: Device & Component Integration, Step10: Application Development.

UNIT IV Advanced Topics in IoT **10 Hours**

Logical Design of IOT using Python, Introduction to Python, Basics of Programming with Rasphberry PI with PYTHON, IOT Physical devices and end points. Python Packages of Interest for IoT-JSON. IoT Physical Servers & Endpoints.

Text Book:

1. Internet of Things-An Hands on Approach-Vijay Madisetti (Author),ArshdeepBahga,2014

(chapter 1,3,4, 5, 6).

Reference Books:

1. Cuno P fister Getting Started with the Internet of Things, OReilly, 2011.
2. Francis Da Costa, Rethinking Internet of things, Apress Open Edition, 2013
3. Adrian Mc Ewen, Hakim Cassimally, Design of Internet of Things, 2014 John Wiley and Sons, Ltd.

M20MS2070	Python Lab	Course Type	L	T	P	C
Duration :26 Hrs		SC	0	0	2	2

Course Objectives:

The objectives of this course are to:

- Describe the basic components of Machine Learning with concepts of Python Programming
- Differentiate broad categories of Machine learning Programming
- Compare different types of Programming used in Machine Learning domain with limitations
- Examine the limitations of various machine learning algorithms and the way to evaluate performance of machine learning algorithms

Course Outcomes:

On successful completion of this course; the student will be able to:

- Explain concepts and Programming of Machine Learning
- Formulate innovative ideas or techniques of machine learning for the real world problems
- Apply Machine Learning algorithms/ Programming for specific problems.
- Understand the challenges and issues related to machine learning application Programming

LAB EXPERIMENTS:

PART A

1. Demonstrate runtime reading of Strings.

   ii) Illustrate the concept of String Slicing.

iii) Also demonstrate a minimum of 5 functions defined on Strings.

2. Write a program to add two integers and print the result on the screen. Accept the values at runtime.
3. Demonstrate the usage of math and cmath UNIT.(For Ex. Program to find the roots of a Quadratic Equation)
4. Illustrate the usage of files with the help of different functions defined on Files(such as write, read(demonstrate all four forms), open, and close(use both the forms of closing a file)
5. Write a program to find the largest of two numbers
6. Write a program to find the biggest of three numbers
7. Design a menu driven program to check whether the number is
   i)A perfect number or not ii)Armstrong number or not iii)Palindrome or not
8. Show the different operations defined on Lists, Tuples and Dictionaries
9. Write a program to find the factorial of a number using functions and without using functions. Accept the input at runtime.
10. Demonstrate the i) Designing of a class ii) Creation of Object of that class iii) accessing the methods and instance variables in the class. The student is at the liberty of choosing their own Description of the object for designing the class.

PART B:

Lab units:

1. Implementation of regression algorithm
2. Implementation of Naïve Bayes algorithm
3. Implementation of Decision Tree algorithm
4. Implementation of K-means algorithm
5. Implementation of PCA algorithm
6. Implementation of SVM algorithm
7. Implementation of Q- algorithm

The above algorithms has to be executed on different sets/types of datasets.

M20MS2080	NoSQL Lab	CourseType	L	T	P	C
Duration : 26 Hrs		SC	0	0	2	2

Course Objectives:

The objectives of this course:

- Learn the latest trends in databases.
- Learn various NoSql systems and their features
- Compare NoSql databases with each other and relational systems
- Learn emerging databases like MongoDB, HBase.

Course Outcomes:

On successful completion of this course, the student will be able to:

- Define, compare and use the four types of NoSQL Databases (Document oriented, Key Value Pairs, Column oriented and Graph).
- Analyze the need of NoSQL databases in handling Big data.
- Compare the Difference between the types of NOSQL databases.
- Demonstrate the data models in these databases.

LAB EXPERIMENTS:

CRUD Operations in MONGODB

1: Student Database

Create a Student database with the fields: (SRN, sname, degree, sem, CGPA)

i. Insert 10 documents.
ii. Display all the documents.
iii. Display all the students in BCA.
iv. Display all the students in ascending order.

v. Display first 5 students.
vi. Display students 5,6,7.
vii. List the degree of student "Rahul".
viii. Display students details of 5,6,7 in descending order of age.
ix. Display the number of students in BCA.
x. Display all the degrees without _id.
xi. Display all the distinct degrees.
xii. Display all the BCA students with CGPA greater than 6, but less than 9.
xiii. Display all the students in BCA and in 6th Sem.

2. Employee Database

Create an employee database with the fields: {eid, ename, dept, desig, salary, yoj, address {dno, street, locality, city}}

i. Insert 10 documents.
ii. Display all the employees with salary in range (50000, 75000).
iii. Display all the employees with designation.
iv. Display the Salary of “Rahul”.
v. Display the city of employee “Rahul”.
vi. Update the salary of developers by 5000 increment .
vii. Add field age to employee “Rahul”.
viii. Remove YOJ from “Rahul”.
ix. Add an array field project to “Rahul”.
x. Add p2 and p3 project to “Rahul”.
xi. Remove p3 from “Rahul”.
xii. Add a new embedded object “contacts” with “email” and “phone” as array objects to “Rahul”.
xiii. Add two phone numbers to “Rahul”.

3. Book Database

Create a book Data Base with the fields: (isbn, bname, author [], year, publisher, price)

i. Insert 5 documents.

ii. List all the documents.
iii. List all book names except year and price.
iv. Display all the books authored by rudresh.
v. List all the books published by pearson.
vi. List the publisher of book java.
vii. List the author, publisher and year of the book let us see.
viii. Display the price of "let us see" except _id.
ix. Sort and display all books in ascending order of book names.
x. Sort and display only 3 books in descending order of price.
xi. Display all the books written by herbet and kuvempu.
xii. Display all the books either written by herbet and kuvempu.
xiii. Display all the books where rama is the first author.

4. Food Database

Create a Food Database with the fields: (food id, food cat, food name, chef name [ ], price, ingredients [], hotel name, hotel address {no, street, locality, city})

i. Insert 10 documents.
ii. List the price of pizza with ingredients.
iii. Display the item in the price range(500,800).
iv. Display the item prepared by x and y.
v. Display the item prepared by x or y.
vi. Add one chef to the food pizza.
vii. Add ingredients to the food Burger.
viii. Delete last ingredient added to the food burger.
ix. Delete all the ingredients from the food biryani.
x. Add food type to the food Burger.
xi. Modify the burger price by 200.
xii. Add or insert a new food item with the food Id "f08 " usingupsert as True.
xiii. Increment the price of all food item in food cat: fastfood by 120.

5. Import and export Bigdata to MongoDB

PART B

PHP with MONGODB

1. Demonstrate how to establish connection between PHP and MongoDB.
2. Grouping Data with Map/Reduce
3. Create Employee Database (PHP) and perform following operations.
   i. Connect to MongoDB.
   ii. Insert 5 documents into the employee database.
   iii. Find all documents in the database.
   iv. Find one document with condition.
   v. Display two Documents in the database using LIMIT Command.
   vi. Display from 5^{th} document.
   vii. Sort the documents in Ascending order based on pin.
   viii. Display the prescribed number in an array object using SLICE operator.
   ix. Display the prescribed number in an array object using SLICE with SKIP-LIMIT.
4. Create Employee Database (PHP) and perform following operations.

   i. Connect to MongoDB.
   ii. Insert 5 documents into the employee database.
   iii. Display find with condition (where)
   iv. Demonstrate OR condition, AND condition, Conditional operators lt,lte,gt,gte,ne, in operator, all operator, EXISTS operator-checks whether field has a value.

4. Demonstrate Indexing in MongoDB.

THIRD SEMESTER

M20MS3010	Cloud Computing	CourseType	L	T	P	C
Duration :52 Hrs		HC	4	0	0	4

Course Description:

This course introduces the fundamental principles of Cloud computing and its related paradigms. It discusses the concepts of virtualization technologies along with the architectural models of Cloud computing. It presents prominent Cloud computing technologies available in the marketplace. It contains topics on concurrent, high-throughput and data-intensive computing paradigms and their use in programming Cloud applications. Various application case studies from domains such as science, engineering, gaming, and social networking are introduced along with their architecture and how they leverage various Cloud technologies. Hope that this motivates the students to address their own future research and development.

Prerequisites:

OS, Visualization, Networking

Course Objectives:

The objectives of this course are to:

- introduce the broad perceptive of cloud architecture and model
- Understand the concept of Virtualization and design of cloud Services
- Be familiar with the lead players in cloud.
- Apply different cloud programming model as per need.
- Learn to design the trusted cloud Computing system

Course Outcomes:

On successful completion of this course; the student will be able to:

- Understand the fundamentals of Cloud Computing and evaluate ideas for building cloud computing environments.

- Explain the fundamental concepts of Virtualization and analyze the characteristics of virtualized environments.
- Analyze existing cloud architecture to design and develop new systems using software tools that can solve real time problems without harming environment.
- Explore cloud computing applications in various areas and analyze their usage.

Course Contents:

UNIT I Fundamentals of Cloud Computing **13 Hours**

Cloud computing at a glance, The vision of cloud computing, Defining a cloud, A closer look, Historical developments, Building cloud computing environments Application development. Characteristics of Cloud computing. Scalability, types of scalability. Horizontal Scalability and Cloud Computing. Computing platforms and technologies,Principles of Parallel and Distributed Computing. Programming Models: Parallel and Distributed Programming Paradigms , MapReduce.

UNIT II Fundamental concept and Models **13 Hours**

Basics of Virtualization, Characteristics of virtualized environments, Taxonomy of virtualization techniques, - Types of Virtualization, Virtualization and cloud computing, Technology examples, Xen: paravirtualization, VMware: full virtualization –Just introduction.

UNIT III **13 Hours**

Cloud Infrastructure Mechanisms and Architecture

Fundamentals of Cloud Architecture, The cloud reference model, Cloud Delivery Models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Comparing Cloud Delivery Models, Cloud Deployment Models: Public Clouds, CommUnity Clouds, Private Clouds, Hybrid Clouds.**Cloud Platforms** – Aneka.Framework overview, Anatomy of the Aneka container, Aneka Deployment modes-Private, Public and Hybrid

Amazon Web Services overview.**Cloud Applications** :Healthcare, Social networking.

UNIT IV Fog and Edge computing **13 Hours**

Fog Computing, Fog computing architecture, Fog Node, Fog Computing Essential Characteristics, Fog Node Attributes, Fog Service and Deployment models, Fog enabled IOT network.

Edge computing –overview, architecture, Edge vs Fog, Edge computing and IOT, Impact of Edge computing in 5G network.

Text Books

1. Rajkumar Buyya,ChristianVechiolla,ThamaraiSelvi,"**Mastering Cloud Computing**, Elsevier publications,2013,USA. (UNIT-I : Chapter 1 and 2, UNIT-II: Chapter 3, UNIT-III:Chapter 4,5.1, UNIT-IV:Chapter 8,9.1,9.2 and 10)

References Books

1. Rajkumar Buyya,James Broberg,AndrzejGoscinski,"Cloud Computing:Principles and Paradigms",Wiley,India.
2. KaiHwang, Geoffrey C Fox,Jack G Dungaree,"Distributed and Cloud Computing, From Parallel Processing to the Internet of Things",Morgan Kaufmann Publishers,2012
3. Thomas Erl, Zaigham, Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology & Architecture",Prentice Hall/Pearson.

M20MS3021	Intelligent Systems	CourseType	L	T	P	C	Hrs./Wk.
Duration : 40 Hrs		SC	2	1	0	3	3

Course Description:

This course introduces the matrices and continuous time State space model along with linearization. It emphasizes Stability for linear systems, time varying system, discrete time system and non linear state space model and its control strategies. Also it gives insight into Fuzzy systems along with its control and stability.

Course Outcomes:

After successful completion of the course, the students will be able to-

- Explain the importance of matrices, space models and linearization.
- Describe stability theory for time invariant and time varying systems.
- Understand the various control strategies and neural networks.
- Apply fuzzy logic and use of fuzzy logic in related models.

Course Contents:

UNIT I **10 Hours**

Introduction: Norms of Signals, Vectors and Matrices, Positive Definite Functions, Positive Definite Matrices; Continuous time State space Model, L TI State space Model, Nonlinear State space model, Equilibrium point and Linearization using first order Taylor series, Linearization technique for operating points other than origin.

UNIT II **10 Hours**

Lyapunov Stability Theory, Lyapunov stability of time invariant system, Lyapunov stability of time varying system, Lyapunov's indirect method, Lyapunov stability for linear systems; Discrete time Systems, Discrete time L TI State space Model, Discrete time Nonlinear State space model, Lyapunov Stability for Discrete Time Systems.

UNIT III **10 Hours**

Nonlinear Control Strategies: Feedback Linearization, Backstepping Design, State feedback linearizable systems. Feed-Forward Networks: Multilayered Neural Networks, Radial Basis Function Networks. Adaptive Learning Rate; Feedback Networks, Back Propagation Through Time (BPTT), Real Time Recurrent Learning (RTRL).

UNIT IV **10 Hours**

Fuzzy Sets, Control and Stability: Classical sets, Fuzzy Sets, Concept of a fuzzy number, Operations on Fuzzy sets, Properties of Fuzzy Sets; Extension Principle of Fuzzy Sets, Crisp Relation, Fuzzy Relations, Projection of Fuzzy Relations, Fuzzy Rule Base and Approximate Reasoning, Fuzzy Rulebase, Fuzzy Implication Relations, Fuzzy Compositional Rules, Approximate Reasoning; Fuzzy Logic Control (FLC), Takagi Sugeno (TS) Fuzzy Model; System Identification Using TS Fuzzy Models, The TS Model From Input Output Data, The TS Fuzzy Model Using Linearization.

Textbooks:

1. Alexander M. Meystel, James S. Albus, “Intelligent Systems: Architecture, Design, and Control”, Wiley Series on Intelligent Systems, 1st Edition, 2001.

2. Pedro Ponce Cruz and Fernando D. Ramirez Figueroa, “Intelligent Control Systems with LabVIEW™, Springer, 1st Edition, 2009.

M20MS3022	Deep Learning Techniques	Course Type	L	T	P	C
Duration :40 Hrs		SC	2	1	0	3

Course Description:

Understanding the latest advancements in artificial intelligence can seem overwhelming, but it really boils down to two very popular concepts Machine Learning and Deep Learning. But lately, Deep Learning is gaining much popularity due to its supremacy in terms of accuracy when trained with huge amount of data. Deep learning is a type of machine learning that mimics the neuron of the neural networks present in the human brain. The “Big Data Era” of technology will provide huge amounts of opportunities for new innovations in deep learning. Deep Learning really shines when it comes to complex problems such as image classification, natural language processing, and speech recognition. The course will examine neural networks and deep learning techniques in detail that can be applied to solve a complex real-world scenario.

Prerequisites:

Data Analytics, Machine Learning

Course Objectives:

The objectives of this course are to:

- Illustrate the foundation of neural networks and deep learning.
- Formulate deep networks for different applications.
- Demonstrate different deep learning architectures.
- Validate deep learning techniques in object recognition and computer vision.

Course Outcomes:

On successful completion of this course; the student will be able to:

- Describe deep learning and why it is essential to the design of intelligent machines.
- Design the deep networks for various real world applications.
- Acquire the knowledge in deep learning and be able to implement deep learning models for language, vision, speech, decision making and more.
- Discriminate different deep learning architectures.

Course Contents:

UNIT I **10 Hours**

Foundations of Neural network and Deep Learning

Neural Networks: The biological Neuron-The perceptron-Multilayer feed forward networks. Training neural networks: Back propagation learning. Activation function: Linear-sigmoid- tanh-hard tanh-soft max-rectified linear. Loss functions: Loss function notation-loss function for regression-loss function for classification-loss function for reconstruction. Hyper parameters: Learning rate, regularization, momentum, sparsity.

UNIT II **10 Hours**

Fundamentals of Deep networks

Defining deep learning and deep networks- advantages in network architecture-from feature engineering to automated feature learning-common architecture principles of deep networks: Parameters-layers-activation function-loss function-optimization methods-hyper parameters. Building blocks of deep networks: RBMs-auto encoders- variational auto encoders.

UNIT III **10 Hours**

Major Architecture of Deep networks

Unsupervised pre trained networks: Deep belief networks-generative adversarial networks-convolutional neural networks (CNNs): Biological inspiration-intuition-CNN architecture overview-input layers-convolutional layers-pooling layers-fully connected layers-other applications of CNNs

UNIT IV **10 Hours**

Recurrent and recursive neural networks

Recurrent neural networks: Modelling the time dimension-3D volumetric input-general recurrent neural network architecture-LSTM networks-domain specific applications and blended networks. Recursive neural networks: Network architecture- varieties of recursive neural networks- Basic concepts in tuning deep networks and vectorization. Applications in object recognition and computer vision.

Text Books

1. Josh Patterson and Adam Gibson, "Deep Learning A practitioners Approach",Shroff publishers & Distributors, First edition 2017.(Chapter 2,3,4,6,7 & 8)

Reference Book

1. Aurelian Geron, "Hands-On Machine Learning with Scikit-Learn & Tensor Flow", Shroff publishers & Distributors, First edition, 2017.
2. Langoog fellow, Yoshuabengio and Aaron courville , "Deep Learning", MIT press, First edition, 2016.
3. Li Deng and Dong Yu, "Deep LearningMethods and Applications",Foundations and Trends *in* Signal Processing,2014.
4. Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015

Web sites

1. www.deeplearning.net
2. www.deeplearning.stanford.edu
3. www.deeplearning.cs.toronto.edu.

M20MS3023	Ubiquitous and Pervasive Computing	Course Type	L	T	P	C
Duration:40 Hrs		SC	2	1	0	3

Course Description:

The course is about the emerging discipline of Ubiquitous & Pervasive Computing, it is about moving beyond the traditional desktop computing model into embedding computing into everyday objects and everyday activities. The key elements are independent information devices including but not limited to wearable computers, mobile phones, smart phones, smart-cards, wireless sensor-compute nodes etc. and the services made available by them in typical Ubiquitous/ Pervasive / Everywhere Computing environment. It includes select aspects of human-computer interaction using several types of elements including sensing, text, speech, handwriting and vision.

Prerequisites:

IoT, Networking

Course Objectives:

The objectives of this course are to:

- Illustrate the foundation of Ubiquitous computing.
- Formulate UbiCom for different applications.
- Demonstrate different Pervasive WAP.
- Demonstrate different PDAs

Course Outcomes:

After the successful completion of the course, the student will be able to

- Understand the basic concepts of Ubiquitous computing.
- Understand applications and requirements of ubiquitous computing.
- Describe the important issues and concerns on security and privacy in ubiquitous computing.
- Design and develop a pervasive computing device for a specific need.
- Develop a framework for pervasive computing.

Course Content:

UNIT I Fundamental of Ubiquitous Computing **10 Hours**

Introduction to Ubiquitous Computing, Ubiquitous Computing History, Ubiquitous Computing Applications- UbiCom as Smart DEI, Modeling of the Ubiquitous Computing Properties; Architectural Design for UbiCom Systems

UNIT II Applications and Requirements **10 Hours**

Smart Devices: CCI; Smart Environments: CPI and CCI; CPI- Unimate and MH 1 Robots, Smart Dust and TinyOS; iHCI and HPI; Ubiquitous Audio Video Content Access, Ubiquitous Information Access and Ebooks, Universal Local Control of ICT Systems, User Awareness and Personal Spaces , Human to Human Interaction (HHI) Applications ,Transaction based M Commerce and U Commerce Services , Enhancing the Productivity of Mobile Humans ,Care in the CommUNITy ,Human Physical World Computer Interaction (HPI) and (CPI)

UNIT III WAP **10 Hours**

Components of the WAP architecture-WAP infrastructure-WAP security issues-WML-WAP push-Products-i-Mode-Voice Technology: Basics of Speech recognition- Voice Standards-Speech applications-Speech and Pervasive Computing

UNIT IV **10 Hours**

Personal digital assistant (PDAs): Device Categories-PDA operation Systems-Device Characteristics-Software Components-Standards-Mobile Applications-PDA Browsers Pervasive Web Application architecture: Background-Scalability and availability-Development of Pervasive Computing web applications-Pervasive application architecture

Text Book:

1. Poslad, S. (2011). Ubiquitous computing: smart devices, environments and interactions. John Wiley & Sons.

2. Burkhardt, J., Schaeck, T., Henn, H., Hepper, S., &Rindtorff, K. (2001). Pervasive computing: technology and architecture of mobile Internet applications. Addison-Wesley Longman Publishing Co., Inc.

References Books:

1. Adelstein, F., Gupta, S. K., Richard, G., &Schwiebert, L. (2005). Fundamentals of mobile and pervasive computing (Vol. 1). New York: McGraw-Hill.
2. Bhargava, D., & Vyas, S. (Eds.). (2019). Pervasive Computing: A Networking Perspective and Future Directions. Springer Singapore.

M20MS3031	Advanced Image Processing and Analysis	Course Type	L	T	P	C
Duration: 40 Hrs		SC	2	0	1	3

Course Description:

Advanced Digital image processing has various applications ranging from remote sensing and entertainment to medical applications. This course explores a few major areas of digital image processing at an advanced level, with primary emphasis on medical applications. The primary goal of this course is to lay a solid foundation for students to study advanced image analysis topics such as computer vision systems, biomedical image analysis, and multimedia processing & retrieval.

Prerequisites:

Digital Image Processing, Advanced programming skills related to imaging (C++, imaging libraries, Matlab or equivalent).

Course Objectives:

Explain the fundamentals and different imaging techniques.

- Employ digital image fundamentals in spatial and frequency domain approaches.
- Demonstrate image degradation/ restoration model.
- Illustrate image segmentation and morphological operations.

Course Outcomes:

After completion of the course the scholar shall be able to**:**

- Identify various applications of image processing and apply the basic operations such as digitization, sampling and quantization on images.
- Differentiate smoothing, sharpening and point operations in spatial and frequency domain.
- Apply various noise models and restoration techniques in digital images.
- Analyse different image compression algorithms.
- Demonstrate image segmentation algorithms and employ different morphological operations.

UNIT I **10 Hours**

Fundamentals of Digital image processing: Introduction to digital image processing-Gamma ray imaging- X-Ray imaging-Imaging in the ultra violet band-Imaging in visible and infrared bands - fundamental steps in image processing-components of image processing system-Elements of visual perception-Light and electromagnetic spectrum-Image sensing and acquisition-Image sampling and quantization-relationship between pixels-linear and non-linear operations.

UNIT II **10 Hours**

Digital image fundamentals: Image Sensing and Acquisition- Image Sampling and Quantization-Some Basic Relationships between Pixels-Neighbours of a Pixels-Adjacency-Connectivity- Regions-Boundaries-Distance Measures.**Spatial and frequency domain processing:** Image Enhancement in the spatial domain-Some basic gray level transformations-Histogram processing- Basics of spatial filtering-Smoothing spatial filters-Sharpening spatial filters-Image enhancement in frequency domain: Introduction to Fourier transform and the frequency domain-Smoothing frequency domain filters-Sharpening frequency domain filters-Homomorphic filtering.

UNIT III **10 Hours**

Image restoration and Compression: Image degradation/restoration model-various noise models-restoration in the presence of noise (Spatial Filtering)-periodic noise reduction by frequency domain filtering-Estimating the degradation function-Inverse filtering-different image transformations-wavelet transformation-Image compression fundamentals-Image compression models-Lossy compression-Image compression standards.

UNIT IV **10 Hours**

Morphological processing and image segmentation: Introduction to Morphological processing-Dilation and Erosion operations-Opening and closing-The Hit or Miss Transformation- Some basic morphological algorithms- applications of gray scale morphology. **Image segmentation**: Detection of discontinuities- Edge linking and boundary detection-Thresholding-region based segmentation-Segmentation by morphological watersheds-use of motion in segmentation.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education India, 2018.

2. William K Pratt, "Digital Image Processing", John Willey publications, 2002.

References Books:

1. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

M20MS3032	Multivariate Methods for data Analysis	Course Type	L	T	P	C
Duration : 40 Hrs		SC	2	0	1	3

Course Objectives:

Large amount of data is collected on many different variables across disciplines in order to understand the underlying process (es). The multivariate analysis of data deals with examining interrelationship between three or more equally important variables or explaining of variation in, usually one (or more than one) dependent variable(s) on the basis of two or more independent (explaining) variables. With the availability of inexpensive, fast and efficient computing resources and statistical packages there has been a growth in the application of these techniques. This course introduces the student to various multivariate data analysis tools.

Prerequisites:

Multivariate calculus, linear algebra, and mathematical statistics

Course Objectives:

The objectives of this course are to:

- Cover differential, integral and vector calculus for functions of more than one variable.
- Learn mathematical tools and methods are used extensively in the physical sciences, engineering, economics and computer graphics

Course Outcomes:

On successful completion of this course; the student will be able to:

- Apply Matrices and Vectors on free-body diagrams
- Construct free-body diagrams.
- Understand of the analysis of distributed contents.

Course Content:

UNIT I **10 Hours**

Matrices and Vectors: Matrices, Matrices Operations, Related Matrices, Determinants, Properties of Determinants, Solution of Linear System of Equations, Vectors, Scalar or Dot Product, Vector or Cross product, Scalar Product of Three Vectors, Vector Product of Three Vectors, Differentiation of Vectors, Velocity and Acceleration.

UNIT II **10 Hours**

Partial Differentiation and its Applications: Functions of Two or More Variable, Partial Derivatives, Homogeneous Functions, Total Derivative, Geometrical Interpretation, Taylor's Theorem for functions of Two Variables, Maxima and Minima of Functions of Two Variables, Lagrange's Method of Undetermined Multipliers. Scalar and Vector Point Functions, Del Applied to Scalar Point Functions – Gradient, Del applied Twice to Point Functions, Del Applied to Products of Point Functions.

UNIT III **10 Hours**

Double Integrals and its Applications: Double Integrals, Change of Order of Integration, Double Integrals in Polar Coordinates; Area enclosed by Plane Curves, Integration of Vectors, Line Integral, Surface, Green's Theorem in the Plane, Stoke's Theorem.

UNIT IV **10 Hours**

Triple Integrals and its Applications: Triple Integrals, Volumes of Solids, Change of Variables, Area of a Curved Surface, Calculation of Mass, Centre of Gravity, Centre of Pressure, Volume Integral, Green's Theorem, Irrotational Fields, Solenoidal Fields, Orthogonal Curvilinear Coordinates, Cylindrical Coordinates, Spherical Polar Coordinates.

Text Book:

1. B S Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015, ISBN No: 978-81-7409-195-5

References Books :

1. Calculus, Early Transcedentals Plus New May Math Lab by William Briggs, Lyle Cochran, and Gillet Pearson, Addison-Wesley, 2014.

2. Edwards, Henry C., and David E. Penney, Multivariable Calculus. 6th ed. Lebanon, IN: Prentice Hall, 2002. ISBN: 9780130339676.

M20MS3033	Advanced Java Programming	Course Type	L	T	P	C
Duration: 40 Hrs		SC	2	0	1	3

Course Description:

The goal of the course is to help students gain knowledge in the basic concepts of object-oriented programming and build skills to develop modern software programmers using the language Advanced Java. The course helps to provide an overview of working principles of web related functionalities in Java, understand and apply the fundamentals core java, packages, database connectivity for computing

Prerequisites:

Java Programming

Course Objectives:

- Gain mastery in various advanced features like generic programming, Servlets, JSP, J2EE, JDBC.
- Impart the major Software Design Patterns available in J2EE to meet demanding Software Engineering problems encountered in various Industries.
- Provide hands on experience working with the various J2EE features.
- Describe the J2EE Specifications to produce well designed, effective web applications using JSP and supportive technologies.

Course Outcomes:

- Apply the generic programming techniques
- Understand the components and patterns that constitute a suitable architecture for a web application using java servlets.
- Demonstrate systematic knowledge of backend and front end by developing an appropriate application.
- Develop a web application with specific characteristics using JSP

Course Content:

UNIT I Generics & Event Handling & Swing 11 Hours

Generics: Generics Fundamentals - A Simple Generics Example - Generics Work Only with Reference Types - Generic Types Differ Based on Their Type Arguments - A Generic Class with Two Type Parameters - The General Form of a Generic Class - Bounded Types - Using Wildcard Arguments - Bounded Wildcards - Generic Methods - Generic Constructors - Generic Interfaces. Event Handling, AWT Programming

UNIT II Swings & Java Beans 10 Hours

Introduction to Swing:JApplet, Handling Swing Controls like Icons – Labels – Buttons – Text Boxes – Combo – Boxes – Tabbed Pains – Scroll Pains – Trees – Tables Differences between AWT

Controls & Swing Controls Developing a Home page using Applet & Swing. **Java Beans**: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizers, Java Beans API.

UNIT III Servlets & Java Server Pages **11 Hours**

Servlets: Introduction to Servelets: Lifecycle of a Serverlet, JSDK TheServelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues **JSP:**Introduction, JSP Life Cycle, JSP API, JSP Scripting elements, JSP Implicit Objects, JSP directives, JSP Action Tags, MVC in JSP, JSTL, JSP, JSP Custom Tags, JSP Pagination.

UNIT IV JDBC **08 Hours**

Database Access Database Programming using JDBC Studying Javax.sql. package Accessing a Database from a JSP Page Application – Specific Database Actions Deploying JAVA Beans in a JSP Page.

Text Books:

1. Jim Keogh, The Complete Reference J2EE , Tata McGrawHill Publishing Company Ltd,2002.
2. Herbert Schildt, Java A Beginner ‘s Guide Sixth Edition, Oracle Press, MCH Education, 6th Edition.
3. Internet and World Wide Web – How to program by Dietel and Nieto Pearson Education Asia.
4. The complete Reference Java 2 Third Edition by Patrick Naughton and Herbert Schildt.
5. Java Server Pages by Hans Bergstan.

Reference Books:

1. A Brain-Friendly Guide Head First Servlets and JSPs, Bryan Basham, Kathy Sierra and Bert Bates, Oreilly, 2nd Edition.

2. Programming Jakarta Struts By Chuck Cavaness, Oreilly.

ADVANCED JAVA PROGRAMMING

LAB EXPERIMENTS:

1. Demonstrate the generic programming to implement sorting the list of integer and float elements.
2. Write a JAVA Servlet Program to implement a dynamic HTML using Servlet (user name and Password should be accepted using HTML and displayed using a Servlet).
3. Write a JAVA Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such types of pages, you would need to refresh your web page regularly; Java Servlet makes this job easy by providing refresh automatically after a given interval).
4. Write a JAVA Servlet Program to implement and demonstrate get() and Post Methods (Using HTTP Servlet Class).
5. Write a JAVA JSP Program to implement verification of particular user login and display a Welcome page.
6. Write a JAVA JSP Program which uses JSP: include and JSP: forward action to display a Webpage.
7. Write a JAVA JSP Program to get student information through an HTML and create a JAVA Bean Class, populate Bean, and display the same information through another JSP.
8. Write a JSP Program to implement all the attributes of the page directive tag.
9. Develop a Banking Account Application using the Struts concept. You can also use JSP or Servlets, JDBC concepts.
10. Write a JAVA Program to insert data into Student DATABASE and retrieve info based on particular queries(For example update, delete, search etc…).

OPEN ELECTIVE

M20MS3040	Digital Marketing	Course Type	L	T	P	C
Duration : 52 Hrs		OE	4	0	0	4

Prerequisites:

Optimization techniques

Course Objectives:

- To develop industry background knowledge to knowledgeably navigate Internet Marketing topics including online advertising, search, social media, and online privacy.
- To evaluate an experiment quantitatively and qualitatively to measure the effectiveness of business decisions and online advertising effectiveness in particular.
- To design and implement an experiment.
- To apply best practices for social media marketing.

Course Outcomes:

Upon Completion of the course, the students will be able to:

- Assess the impact of digital technology on the practice of marketing.
- Analyze the use of different forms of digital marketing in the development of an online presence.
- Develop a plan for marketing a product of business online.
- Integrate social media tools into a marketing communications strategy.
- Use a publishing platform to build a web presence with integrated data collection and links to social media.

Course Content:

UNIT I **13 Hours**

Introduction To Digital Marketing: Start with the Customer and Work Backward, What Are the 3i Principles?**Search Engine Optimization (Seo):** An Introduction, Search Engine Result Pages: Positioning, Search Behavior, Goals, On-Page Optimization, Off-Page Optimization, Analyze.

UNIT II **13 Hours**

Pay Per Click: An Introduction, Goals, Setup, Manage, Analyze. **Digital Display Advertising :**An Introduction, Display Advertising: An Industry Overview, Define, Format, Configure, Analyze

UNIT III **13 Hours**

Email Marketing: An Introduction, Data—Email Marketing Process, Design and Content, Delivery, Discovery. **Mobile Marketing:**An Introduction, OpportUNITy, Optimize, Advertise, Analyze.

UNIT IV **13 Hours**

Social Media Marketing (Smm): An Introduction, Goals, Channels, Implementation, Analyze, Laws and Guidelines

Text Books:

1. Ian Dodson–" THE ART OF DIGITAL MARKETING : The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns",1st Edition, Wiley Publications, 2016. (Chapters : 1, 2, 3, 4, 5, 6, 7, 8, 9).

Reference Books:

1. Damian Ryan – "UNDERSTANDING DIGITAL MARKETING : Marketing Strategies for engaging the digital generation" 4th Edition, Kogan Page, 2017.
2. Ryan Deiss and Russ Henneberry – "DIGITAL MARKETING : For Dummies ", , John Wiley & Sons, Inc, 2017.
3. Alan Charlesworth – " DIGITAL MARKETING : A Practical Approach", 2nd Edition, Routledge, 2009.

M20MS3050	Minor Project	Course Type	L	T	P	C
Duration : 14 Weeks		HC	0	0	6	6

Prerequisites:

Programming and logical skill set

Course Objectives:

To carry out the research under the guidance of supervisor and in the process learn the techniques of research.

Course Outcomes:

On successful completion of the project, the student shall be able to:

- Familiarize with literature search
- Conduct the experiments related to research and formulate computational techniques
- Interpret the primary data.
- Write report and defend the research findings.

PROJECT:

Each student or a group of maximum of 3 students will choose the topic of research and work under the guidance of allocated faculty member. The project shall preferably be application oriented or industry need based that could be useful to the society. In case of industry need based project or R & D project, the student may opt co-supervisor from the concerned industry / research institution as the case may be. The student will have to make a preliminary survey of research done in broad area of his/her area of interest and decide on the topic in consultation with his/her supervisor(s). The project work floated should be completed within 16 weeks and project report has to be submitted within the stipulated date by the University/ within 18 weeks whichever is earlier. The student has to meet the concerned supervisor(s) frequently to seek guidance and also to produce the progress of the work being carried out. The student should also submit progress report during 5^{th} week and 10^{th} week of the beginning of the semester and final draft report with findings by 15^{th} week. After the completion of the project the student shall submit project report in the form of dissertation on a specified date by the School.

FOURTH SEMESTER

SL.No	Course Code	Title of the Course	Credit Pattern L:T:P:J	Credits
1	M20MS4010	Research/Technical paper	0:0:0:2	2
2	M20MS4020	Internship/ Certification	0:0:0:6	6
3	M20MS4030	Major Project	0:0:0:12	12
Total Credits				**20**

*** Note:**

1. Project Work and Dissertation will be mandatory of 12 Credits

2. The student can select either Internship (4 weeks) or Certification Course for 6 Credits.

3. All final year project students must write & publish a technical/Research paper based on their area of interest that carries 2 credit.

Guide Lines

Project survey has to be completed and problem identification for the project must be done. Students must meet the guide and discuss with due PPT presentations at least two hours per Wk. and do the necessary ground work for Phase II devoting at least 6 hours per Wk.

- The project should be inter disciplinary
- Team size should be of max ***one*** members
- Use any version control software
- Project should be of Research Based
- Proper and meaningful reports should be generated by making use of latest reporting tools
- Project report should follow standard template with the following contents:
    a) Abstract
    b) Introduction to project
    c) Literature Review
    d) Basic Diagrams like (DFD, ER, Class diagram, etc..)

e) Methodology
f) Result Analysis
g) Concussion
h) Future enhancement
i) Bibliography

Project reports should be submitted for evaluation.

CAREER DEVELOPMENT AND PLACEMENT

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improves their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Computer Science is not only knowledge in the subject, but also the skill to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his / her interest and March forward to make better career. The School of Computer Science and Applications also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU’s with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students’ exchange programs for higher learning and for conducting certification programs.

Programme Regulations

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Post Graduate Degree Program

1.0 Teaching and Learning Process

The teaching and learning process under CBCS-CAGP of education in each course of study will have three components, namely-

(i) L= Lecture (ii) T= Tutorial (iii) P= Practice, where:

L stands for **Lecture** session consisting of classroom instruction.

T stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for **Practice** session and it consists of Hands on Experience / Laboratory Experiments / Field Studies / Case Studies that equip students to acquire the much required skill component.

2.0. A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

2.1. Various course of s**tudy** are labeled and defined as: (i) Core Course (CC) (ii) Hard Core Course (HC), (iii) Soft Core Course (SC), (iv) Foundation Core Course (FC) and (v) Open Elective Course (OE).

(i) **Core Course:** A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course.

(ii) **Foundation Course (FC):**

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

(iii) **Hard Core Course (HC):**

The **Hard Core Course** is a Core Course in the main branch of study and related branch (es) of study, if any that the candidates have to complete compulsorily.

(iv) **Soft Core Course (SC):**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

(v) O**pen Elective Course:**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure is called an O**pen Elective Course.**

2.2. Project Work:

Project work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem.

2.3. Minor Project:

A project work up to **Six to Eight credits** is called **Minor Project** work. A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned.

2.4. Major Project / Dissertation:

A project work of **EIGHT, TEN, TWELVE, SIXTEEN or TWENTY** credits is called **Major Project** work. The Major Project / Dissertation shall be Hard Core.

3.0. Minimum Credits to be earned:

3.1. A candidate has to earn 90 credits for successful completion of M.S in Computer Science degree with a distribution of credits for different courses as prescribed by the university.

3.2. A candidate can enroll for a maximum of 32 credits per Semester. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

3.3. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to IV semester and complete successfully 90 credits in 4 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

4.0. Add- on Proficiency Certification:

In excess to the minimum of 90 credits for the M.S in Computer Science program, a candidate can opt to complete a minimum of 4 extra credits either in the same discipline/subject or in different discipline / subject to acquire **Add on Proficiency Certification** in that particular discipline / subject along with the M.S in Computer Science degree.

4.1. Add on Proficiency Diploma:

In excess to the minimum of 90 credits for the M.S in Computer Science program, a candidate can opt to complete a minimum of 18 extra credits either in the same discipline/subject or in different discipline / subject to acquire Add on Proficiency Diploma in that particular discipline / subject along with the M.S in Computer Science. The A**dd -on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

5. Scheme of Assessment & Evaluation

5.1.The Scheme of Assessment and Evaluation will have **TWO PARTS**, namely;

i. Internal Assessment (IA); and

ii. Semester End Examination (SEE)

5.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of PG programs shall carry 50 marks each (i.e., 50 marks internal assessment; 50 marks semester end examination).

5.3. The 50 marks of Internal Assessment (IA) shall comprise of:

Internal Test	= 30 marks
Assignments	= 10 marks
Presentations / Quizzes / Case studies	= 10 marks

5.4. There shall be two internal tests conducted as per the schedule given below. The students have to attend all the two tests compulsorily.

- 1st test for 15 marks at the end of 8th week of the beginning of the Semester; and

- 2nd test for 15 marks at the end of the 16th week of the beginning of the Semester; and

5.5. The coverage of syllabus for the said three tests shall be as under:

- For the 1st test syllabus shall be 1st and 2nd unit of the course;
- For the 2nd test it shall be 3rd and 4th unit;

5.6. There shall be two Assignments and two Presentations / Quizzes / Case studies each carrying 5 marks. Hence two assignments carry 10 marks (5+5 marks) and two Presentations / Quizzes / Case studies carry 10 marks (5+5 marks) as stated at Sl.No.5.3 above. In place of assignments and seminars, there shall be model designs or some task based activity wherein the number of designs/ activity the marks each design / activity carries shall be decided by the respective School Board. However such decision shall be done well in advance and it should be announced before commencement of the Semester after communicating the same to the Registrar and Registrar (Evaluation) to avoid ambiguity and confusion among students and faculty members.

5.8. The Semester End Examination for 50 marks shall be held during 19th and 20th week of the beginning of the semester and **the syllabus for the semester end examination shall be entire 4 units**.

5.9. The **duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours.**

5.10. There shall be double evaluation, viz, first valuation by the internal teachers who have taught the subject and second evaluation shall be the external examiner.

5.11. The average of the two evaluations (internal examiner & external examiner) shall be the marks to be considered for declaration of results.

Summary of Continuous Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
First Test	8th Week	1st and 2nd Units	15	Consolidation of 1st and 2nd Unit
Allocation of Topics for Assignments	-	First Unit and second unit		Instructional process and Continuous Assessment
Submission of Assignments	-	First Unit and second unit	5	Instructional process and Continuous Assessment
Presentations / Quizzes/Case studies	-	First Unit and second unit	5	Instructional process and Continuous Assessment
Second Test	16th Week	Third unit and Fourth unit	15	Consolidation of 3rd and 4th Unit
Allocation of Topic for 2nd Assignment	-	2nd half of second unit and 3rd Unit		Instructional process and Continuous Assessment
Submission of Assignments	-	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Presentations / Quizzes / Case studies	-	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Semester End Practical Examination	17th Week	Entire syllabus	50	Conduct of Semester - end Practical Exams

Preparation for Semester–End Exam	16th & 17th Week	Entire Syllabus		Revision and preparation for semester–end exam
Semester End Theory Examination	18th Week & 19th Week	Entire Syllabus	50	Evaluation and Tabulation
	End of 20th Week			Notification of Final Grades

Note:

1. *As per the model making is concerned, the School shall decide about the Marks and the Number of Model Designs and as well the schedule of allocation and presentation of model design(s). If the model design carries 5 marks, there shall be two model designs; and in case of 10 marks, there shall be one model design. However, the decision of the School should be announced in the beginning of the Semester for students to avoid ambiguity and confusion.

2. Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 day after completion of the examination.

3. Practical examination wherever applicable shall be conducted after 2nd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Registrar (Evaluation) who will notify the same immediately.

6. Assessment of Performance in Practicals

6.1. The performance in the practice tasks / experiments shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting

6.2. The 50 marks meant for continuous assessment of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of experiment and write up about the experiment.	20 marks
	Total	**50 marks**

6.3. The 50 marks meant for Semester End Examination, shall be allocated as under:

i	Conduction of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

6.4. The duration for semester-end practical examination shall be decided by the concerned School Board.

7. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

i	Periodic Progress and Progress Reports (25%)
ii	Results of Work and Draft Report (25%)
iii	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%

8. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Mid-term Tests and Assignments), he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the candidate if his/her submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

For every program there will be one grievance cell. The composition of the grievance cell is as follows:-

- The Registrar (Evaluation) - Ex-officio Chairman / Convener

- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.

- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member

9.0 Eligibility to Appear for Semester - end Examination.

Only those students who fulfill a minimum of 75% of attendance in aggregate of all courses including practical courses / field visits etc, as part of the program shall be eligible to appear for Semester End Examination.

10. Requirements to Pass a Course / Semester and Provision to Drop / withdraw Course

10.1 Requirements to Pass a Course

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50 + SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (12 marks) in Semester End Examination (SEE) which is compulsory.

10.2. Requirements to Pass a Semester

To pass the semester, a candidate has to secure minimum of 40% marks in each subject / course of study prescribed in that semester.

10.3. Provision to Carry Forward the Failed Subjects / Courses:

A student who has failed in a given number of courses in odd and even semesters shall move to next semester of immediate succeeding year and final year of the study. However, he / she shall have to clear all courses of all semesters within the double duration, i. e., within **four years** of admission of the first semester failing which the student has to re-register to the entire program.

10.4. Provision to Withdraw Course:

A candidate can withdraw any course within ten days from the date of notification of final results. Whenever a candidate withdraws a course, he/she has to register for the same course in case it is hard core course, the same course or an alternate course if it is Soft Core Course or Open Elective Course.

A DROPPED course is automatically considered as a course withdrawn.

11. Re-Registration and Re-Admission:

11.1. A candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University and is considered as dropped the semester and is not allowed to appear for Semester End Examination (SEE) shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

11.2 In such a case where in a candidate drops all the courses in a semester due to personal reasons,

it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

12. Attendance Requirement:

a. All students must attend every lecture, tutorial and practical classes.

b. In case a student is on approved leave of absence (e g:- representing the university in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

c. Any student with less than 75% of attendance in a course in aggregate during a semester shall not be permitted to appear to the end semester (SEE) examination.

d. Teachers offering the courses will place the above details in the School / Department meeting during the last week of the semester, before the commencement of SEE, and subsequently a notification pertaining to the above will be brought out by the Head of the School before the commencement of SEE examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

13. **The Grade and the Grade Point:**

The Grade and the Grade Point earned by the candidate in the subject will be as given below.

Marks P	**Grade G**	**Grade Point (GP=V x G)**	**Letter Grade**
90 >100	10	v*10	O
80 > 90	9	v*9	A+
70 > 80	8	v*8	A
60 > 70	7	v*7	B+
55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C+
40 > 50	5	v*5	C
0-40	0	v*0	F
ABSENT			**AB**

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks (P=[IA + SEE]) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

14. **Provisional Grade Card:**

The tentative / provisional Grade Card will be issued by the Registrar (Evaluation) at the end of every Semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average** (SGPA). This statement will not contain the list of DROPPED / WITHDRAWN courses.

14.1 Computation of SGPA

The Following procedure to compute the Semester Grade Point Average (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

15. **Challenge Valuation:**

A student who desires to apply for challenge valuation shall obtain a Xerox copy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the Grade awarded to him/her by surrendering the Grade Card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 10 days after the announcement of the results. **This challenge valuation is only for Semester End Examination (SEE) component.**

b. The answer scripts for which challenge valuation is sought for shall be evaluated by another external examiner (third examiner) who has not involved in the first evaluation. The higher of two marks from the average of first two valuations and challenge valuation shall be the final.

16. Final Grade Card:

Upon successful completion of M.S in Computer Science / M.S in Computer Science with Specialization in Data Science and Analytics degree a Final Grade card consisting of Grades / CGPA of all courses successfully completed by the candidate shall be issued by the Registrar (Evaluation).

16.1.Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (90) for M.S in Computer Science degree is calculated taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

CGPA = $\sum$(Ci x Si) / $\sum$Ci Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

CONVERSION OF GRADES INTO PERCENTAGE:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.93 x 10=89.30

17. Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass

Overall percentage=10*CGPA

18. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

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