REVA UNIVERSITY
Bengaluru, India

School of Computer Science & Engineering

B. Tech. in Computer Science and Engineering

Handbook 2020-24

Rukmini Knowledge Park
Kattigenahalli, Yelahanka, Bengaluru – 560064
www.reva.edu.in

REVA UNIVERSITY
Bengaluru, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Handbook

B. Tech. in Computer Science and Engineering

2020-2024

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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 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. M Dhanamjaya

Vice-Chancellor, REVA University

Director's Message

I congratulate and welcome all the students to the esteemed department of Computer Science and Engineering. 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 department 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 Computer 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 CSE. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, AI, Data Science, and Systems. Theoretical foundations of engineering, science, and computer science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization.

The important features of the BTech CSE 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 department has well qualified faculty members in the various areas of Computer Science and Engineering including cloud computing, security, IOT, AI, ML and DL, software

engineering, computer networks, cognitive computing, etc. State of art laboratories are available for the purpose of academics and research.

Dr. Sunilkumar S. Manvi
Director, Department of CSE and CIT

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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 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 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 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, 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 Retrival,VLSIand Embedded Systems, Wireless Sensor Networks, Artificial Intelligance, 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, Counselors 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 center 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 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 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 ShubhaVidaaya, - 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, 6^{TH} Rank in the Super Excellence category by GHRDC, 6^{TH} Rank in All India Law Department Survey, ranked among Top 30 Best B Departments 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 DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Department has a rich blend of experienced and committed faculty who are well qualified in various aspects of Computer Science and Engineering apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The Department offers B Tech in Computer Science and Engineering and postgraduate programs offered in the departmentare: M Tech in Computer Science and Engineering (Both Full time and Part time).

In addition, the department has a unique academic collaboration with the University of Alabama in Huntsville to jointly offer an MS program in Computer Science. In addition, the department has a research center in which students can conduct cutting edge research leading to a PhD degree.

Curricula 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 program 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 computing 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.

Vision

Department of Computer Science and Engineering aspires to create a pool of high-calibre technologists and researchers in the field of computer science and engineering who have potential to contribute for development of the nation and society with their expertise, skills, innovative problem-solving abilities and strong ethical values.

Mission

MD1: To create center of excellence where new ideas flourish and from which emerge tomorrow's researchers, scholars, leaders, and innovators.

MD2: Provide quality education in both theoretical and applied foundations of computerscience and engineering, related inter-disciplinary areas and train students toeffectively apply the

knowledge to solve real-world problems.

MD3: Amplify student's potential for life-long high-quality careers and makethem competitive in ever-changing and challenging global work environment.

MD4: Forge research and academic collaboration with industries and top globaluniversities in order to provide students with greater opportunities.

MD5: Support the society by encouraging and participating in technology transfer.

Quality Policy

The Department of Computer Science and Engineering 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 exihibition, Internship and Enterpreneuship 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.

ADVISORY BOARD

S. No.	Name	Designation
1	Dr. Bhanu Prasad	Professor, Department of Computer and Information Sciences, Florida A & M University (FAMU) , USA
2	Dr. Rajkumar Buyya	Director, Cloud Computing and Distributed Systems Laboratory, Department of Computing and Information Systems, University of Melbourne, Australia
3	Dr. Heggere S. Ranganathi	Professor and Chair, Computer Science Department, University of Alabama in Huntsville, Huntsville, AL 35899, USA.
4	Dr. S. S. Iyengar	Professor, Louisiana State University (LSU), USA.
5	Dr. Manjunath Joshi	Professor, Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar
6	Dr. L. M. Patnaik	Adjunct Professor and INSA Senior Scientist Consciousness Studies Program, National Institute of Advanced Studies, IISc Campus. Bengaluru.
7	Mr. P. B. Kotur	Head - Global Freshers Engagement Program, Wipro Limited, Bengaluru.
8	Dr. Vivek Venkobarao	Continental Corporation Limited, Bengaluru.

CORPORATE ADVISORY BOARD

S. No.	Name	Designation
1	Mr. Suresh Kumar R	CTO CCS India & Digital Incubators at GE-Healthcare Bengaluru, Karnataka, India.
2	Mr. Abhas Abhinav	Entrepreneur specializing in Free Software and Liberated Hardware, Bengaluru, Karnataka, India.
3	Mr. Manjunath D S	Senior Micro Architect, IntelTechnologies India Pvt. Ltd., Bengaluru, Karnataka, India.
4	Mr. T Sabapathy	Nominations Committee Member, CSI, Bengaluru, Karnataka, India.
5	Mr. PrabhugoudaBiradar	VP-Engineering, Huawei Technologies India Pvt. Ltd., Bengaluru, Karnataka, India.
6	Mr. Kiran N	Leader Strategic Enterprise Architecture, Boeing, Bangalore Urban, Karnataka, India.

MEMBERS OF BOARD OF STUDIES

Sl.No	Name, Designation and Affiliation	Status	Correspondence Address
1.	**Dr Sunil Kumar S Manvi** Professor and Director Department of CSE and CIT, REVA University	Chair Person	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
2.	**Dr MallikarjunaShastry P** M Professor,Departmentof CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
3.	**Dr Kiran Kumari Patil**, Professor, Department of CSE, Director UIIC, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
4.	**Dr Mallikarjuna M Kodabagi**, Professor and Deputy Director IQAC, REVA University	, Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
5.	**Dr Ashwin Kumar U M** Professor and Deputy Director, Department of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
6.	**Dr. Meenakshi Sundaram** Associate Professor, Department of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
7.	**Dr. Amuthabala** Associate Professor, Department of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
8.	**Dr. Shantala Devi Patil**Associate Professor, Department of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
9.	**Dr. Vishwanath Y**, Associate Professor Department of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
10.	**Mr. Chetan Shivakumar,** CEO & Cofounder, Aikaan Labs Pvt Ltd, Bengaluru	Member	CEO & Cofounder, Aikaan Labs Pvt Ltd, Bengaluru
11.	**Mr. MuralidharJahagirdhar**, Practice Head Engineering, ATMECS Technology Pvt Ltd, Hyderabad	Member	Practice Head Engineering, ATMECS Technology Pvt Ltd, Hyderabad
12.	**Mr. RavikantSoni**, Technical Manager, Solution Architect, Standard Chartered bank, Bengaluru.	Member	Technical Manager, Solution Architect, Standard Chartered bank, Bengaluru.

13.	**Dr Sanjay**, HoD Dept. of ISE, NITTE Meenakshi Institute of Technology, Bengaluru	Member	HoD Dept. of ISE, NITTE Meenakshi Institute of Technology, Bengaluru
14.	**Dr Raghavendra Kulkarni**, Director of Academics, M. S. Ramaiah University of Applied Sciences, Bengaluru	Member	Director of Academics, M. S. Ramaiah University of Applied Sciences, Bengaluru

B.TECH in COMPUTER SCIENCE AND ENGINEERING PROGRAM

Program Overview

The Department of Computer Science andEngineering (CSE) encompasses a variety of topics that relates to computation, like development of algorithms, analysis of algorithms, programming languages, and software design and computer hardware.Computer Scienceand Engineeringhasrootsinelectricalengineering,mathematics,andlinguistics.In the past computer 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) computer science and engineering will see an exponential growth as the future machines work on artificial intelligence.

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 scientist's invention of the transistor, which made modern-style computing possible, and landed them the 1956 Nobel PrizeinPhysics.Fordecades,computingtechnologywasexclusivetothegovernmentandthemilitary; 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 justbeginning.

Computers have become ubiquitous part of modern life, and new applications are introduced everyday.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 computer science and engineering 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 opportunities the graduates find.

The Department of Computer Science and Engineering at REVA UNIVERSITY offers B. Tech in Computer Science and Engineering programme to create motivated, innovative, creative thinking graduates to fill ICT positions across sectors who can conceptualize, design, analyse, and develop ICT applications to meet the modern-day requirements.

The B. Tech., in Computer Science and Engineering curriculum developed by the faculty at the department of Computer Science and Engineering, 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 abovementioned 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.

Program Educational Objectives (PEOs)

The program helps to develop critical, analytical, innovative, creative and problem solving abilities amongst its graduates. The programme makes the graduates employable as Software Engineers across sectors. With further education and earning of higherlevel degrees help the graduates to pursue a career in academics or scientific organisations as researchers.

The Program Educational Objectives (PEOs):

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

- **PEO-1**: Have a successful professional career in industry, government, academia and defence as an innovative engineer in a team.
- **PEO-2**: Develop a code and solutions to industry and societal needs in a rapid changing technological environment and communicate with clients as an entrepreneur.
- **PEO-3:** Pursue higher studies and continue to learn by participating in conferences, seminars, etc.

Program Outcomes (POs)

On successful completion of the program, the graduates of B. Tech. (Computer 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.

Programme Specific Outcomes (PSOs)

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

- **PSO-1**: Demonstrate the knowledge of Data structures and Algorithms, Operating Systems, Database Systems, Software Engineering, Programming Languages, Digital systems, Theoretical Computer Science, and Computer Networks,cloud computing and artificial intelligence.
- **PSO-2**: Solve latest problems and develop code to address the requirements of Industry through programming.
- **PSO-3:** Use modern tools and techniques in the area of Computer Science and Engineering.

REVA University Academic Regulations

B. Tech., Degree Programs

(Applicable for the programs offered from 2020-24 Batch)

Regulations – B. Tech., Degree Program
Academic Year 2020-21 Batch

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

1. Title and Commencement:

1.1 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**

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

2. The Programs:

These regulations cover the following B. Tech., Degree programs of REVA University offered during 2019-20.

B Tech in:
Bioelectronics Engineering
Civil Engineering
Computer Science and Engineering
Artificial Intelligence and Data Science
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

3. Duration and Medium of Instructions:

3.1 Duration: The duration of theB 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

Department when he/she resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both, listed under a programme; 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

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

4.2.2 **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

4.2.3 **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

4.2.4 **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

4.2.5 **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**

4.2.6 **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.**

4.2.7 **"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.

5. 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)	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.
4	B. Tech. in Bioelectronics		Pass in PUC / 10+2 examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry / Biotechnology / Biology / Computer Science / Electronics / Technical Vocational subjects and 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.

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

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 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

6.3 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.

1 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: CreditPattern

Lectures(L)	Tutorials(T)	Practice (P)	Credits(L:T:P)	Total Credits	TotalContact 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
2	0	0	2:0:0	2	2

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

7. Different Courses of Study:

Different Courses of Study are labeled as follows:

a. Core Course (CC)
b. Foundation Course (FC)
c. Hard Core Course (HC)
d. Soft Core Course (SC)
e. Open Elective Course (OE)
f. Project Work / Dissertation:
g. 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.

8. Credits and Credit Distribution

8.1 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 / Communicative Skills	2-3
2	Environmental Studies / Environmental Sciences	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.

8.6 **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.

8.7 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**.**

8.7.1. 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.

9 Assessment and Evaluation

9.1 The Scheme of Assessment will have two parts, namely;

i. Internal Assessment (IA); and
ii. 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 Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

9.3 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

9.4 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;

9.5 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**

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

9.7 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.

9.8 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.

9.9 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.

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

9.11 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.

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

9.13 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.

9.14 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)

9.15 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.

9.16 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.

9.17 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.

9.18 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 Department. 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 Department about the scope of the curriculum covered and quality of the questions.

9.19 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

9.20 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

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

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

9.23 Online courses may be offered as per UGC norms.
For online course assessment guidelines would be as follows:

1. If the assessment is done by the course provider, then the Department can accept the marks awarded by the course provider and assign the grade as per REVA University norms.
2. If the assessment is not done by the course provider then the assessment is organized by the concerned Departmentand the procedure explained in the regulation will apply
3. 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 at the discretion of the department.

9.24 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.

9.25 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

9.26 **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

10 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.

10.1 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 departmentBoard.

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

For > 3 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern departmentboard (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 departmentboard (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%)

12. 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.

a. 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) = ∑(Ci x Gi) / ∑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**

b. 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** = $\frac{19x6.83+21x7.29+22x8.11+22x7.40+22x8.29+22x8.58+22x9.12+10x9.25}{160}$ = 8.05

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 8.05 x 10=80.5

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

13. 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

< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

a. **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).**

b. **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.

16. Absence during Internal Test:

In case a student has been absent from an 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 Director of the department, for conducting a separate internal test. The Director of the

department 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

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:

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances.

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 department / department/discipline and/or from the sister departments / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University department / department – Member.

19. 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

20. Provision for Supplementary Examination

In casea 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.

21. 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.

Case 1: A student who has failed in a maximum of 4 courses in 1st and 2nd semester together shall move to the 3rd semester of the succeeding year.

Case 2: A student who has failed in a maximum of 4 courses from semester 1 to 4 together shall move to the 5th semester of the succeeding year.

Case 3: A students who has failed in a maximum of 4 courses from semester 1 to 6 together shall move to the 7th semester of the succeeding year.

22. 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.

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

24. All assessments must be done by the respective departments/departments 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.

REVA UNIVERSITY
Bengaluru, India

B. TECH IN COMPUTER SCIENCE AND ENGINEERING

Scheme of Instructions

(Effective from Academic Year 2020 - 21)

I SEMESTER (CYCLE-1)

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/ MC	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	B20AS0106	Physics for Computer Science	HC	3	0	0	3	3
3	B20CS0101	Introduction to Data Science	FC	2	0	1	3	4
4	B20CS0102	Programming for Problem Solving	HC	3	0	1	4	5
TOTAL				11	0	2	13	15
	Practical /Term Work / Practice Sessions/Online /MOOC							
5	B20ME0104	Entrepreneurship	HC	1	0	0	1	1
6	B20EC0101	IoT Applications	FC	1	0	1	2	3
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 (CYCLE-2)

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20AS0204	Probability and Statistics	HC	4	0	0	4	4
2	B20AS0104	Engineering Chemistry	HC	3	0	0	3	3
3	B20CI0101	Introduction to Python Programming	FC	2	0	1	3	4
4	B20EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	1	4	5
5	B20CE0201	Basics of Civil and Mechanical Engineering	HC	3	0	1	4	5
TOTAL				15	0	3	18	21
	Practical /Term Work / Practice Sessions/Online/MOOC							
6	B20AS0109	Biology for Engineers	FC	1	0	0	1	1
7	B20ME0102	Design Thinking	HC	1	0	1	2	3
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/ MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CS0301	Analog and Digital Electronics	HC	3	0	1	4	5
2	B20CI0301	Programming with JAVA	HC	3	0	1	4	5
3	B20CS0302	Data Structures	HC	3	0	1	4	5
4	B20AS0302	Discrete Mathematics and Graph Theory	HC	3	0	0	3	3
5	B20CI0302	Agile software development and DevOps	HC	3	0	0	3	3
TOTAL				15	0	3	18	21
	Practical /Term Work / Practice Sessions/Online/MOOC							
6	B20AH0301	Communication Skills	FC	2	0	0	2	2
7	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
8	B20AHM301/ B20AHM302	Advanced Kannada/ Basics of Kannada	MC	0	0	0	0	2
TOTAL				4	0	0	4	6
TOTAL SEMESTER CREDITS							22	

TOTAL CUMULATIVE CREDITS	62
TOTAL CONTACT HOURS	27

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/ MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EF0401	Design and Analysis of Algorithms	HC	3	0	0	3	3
2	B20EF0402	Unix Operating System	HC	3	0	1	4	5
3	B20EF0403	Database Management System	HC	3	0	1	4	5
4	B20EF0404	Computer Organization and Architecture	HC	3	0	1	4	5
5	B20AS0401	Numerical Methods and Optimization Techniques	HC	3	0	0	3	3
TOTAL				15	0	3	18	21
	Practical /Term Work / Practice Sessions/Online/MOOC							
6	B20MGM301	Management Science	FC	2	0	0	2	2
7	B20AS0303	Environmental Science	FC	2	0	0	2	2
8	B20AHM401	Universal Human Values	MC	2	0	0	0	2
TOTAL				6	0	0	4	6
TOTAL SEMESTER CREDITS							22	
TOTAL CUMULATIVE CREDITS							84	

TOTAL CONTACT HOURS	27

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/ MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EF0501	Web Technologies	HC	3	0	0	3	3
2	B20EF0502	Computer Networks	HC	3	0	0	3	3
3	B20EF0503	Machine Learning	HC	3	0	0	3	3
4	B20EFS511-516	Professional Elective-I	SC	3	0	0	3	3
5	B20EFS517-522	Professional Elective-II	SC	3	0	0	3	3
6	B20XXO5XX	Open Elective-I	OE	3	0	0	3	3
TOTAL				18	0	0	18	18
	Practical /Term Work / Practice Sessions/Online/MOOC							
7	B20EF0504	Modern Databases	HC	2	0	0	2	2
8	B20EF0505	Web Technologies lab	HC	0	0	1	1	2
9	B20EF0506	Computer Networks lab	HC	0	0	1	1	2
10	B20EF0507	Machine Learning lab	HC	0	0	1	1	2
11	B20EF0508	Modern Databases lab	HC	0	0	1	1	2
12	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	1
13	B20EF0509	Skill development-1	HC	0	0	2	2	4

TOTAL	3	0	4	9	15
TOTAL SEMESTER CREDITS				27	
TOTAL CUMULATIVE CREDITS				111	
TOTAL CONTACT HOURS				33	

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/ MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EF0601	Theory of Computation	HC	3	0	0	3	3
2	B20EF0602	Big Data and Cloud Computing	HC	3	0	0	3	3
3	B20EFS611-614	Professional Elective-III	SC	3	0	0	3	3
4	B20EFS615-618	Professional Elective-IV	SC	3	0	0	3	3
5	B20XXO6XX	Open Elective-II	OE	3	0	0	3	3
TOTAL				15	0	0	15	15
Practical /Term Work / Practice Sessions/Online/MOOC								
6	B20EF0603	Research Based Mini Project	HC	0	0	2	2	4
7	B20EF0604	Mobile Application Development	HC	1	0	0	1	1
8	B20EF0605	Big Data and Cloud Computing lab	HC	0	0	1	1	2
9	B20EF0606	Mobile Application Development lab	HC	0	0	1	1	2
10	B20EF0607	Technical Documentation	FC	1	0	0	1	1
11	B20EF0608	Skill development-2	HC	0	0	0	2	4
TOTAL				2	0	4	8	14
TOTAL SEMESTER CREDITS							23	
TOTAL CUMULATIVE CREDITS							134	

TOTAL CONTACT HOURS	29

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EFS711-713	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 / Practice Sessions/Online/MOOC								
3	B20EF0701	Capstone-Project Phase-1	HC	0	0	1	1	2
4	B20EF0702	Internship/Global Certification	HC	0	0	3	3	6
TOTAL				0	0	4	4	8
TOTAL SEMESTER CREDITS							10	
TOTAL CUMULATIVE CREDITS							144	
TOTAL CONTACT HOURS							14	

VIII Semester

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE /MC	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EF0801	Capstone-ProjectPhase-2	HC	0	0	7	7	14
2	B20EF0802	Internship/Global Certification	HC	0	0	3	3	6
3	B20EF0803	MOOC / Competitive Exam	HC	0	0	3	3	6
TOTAL				0	0	13	13	26
Practical /Term Work / Practice Sessions/Online/MOOC								
4	B20XXO8XX	Open Elective-IV	OE	3	0	0	3	3
TOTAL				3	0	0	3	3
TOTAL SEMESTER CREDITS							16	
TOTAL CUMULATIVE CREDITS							160	
TOTAL CONTACT HOURS							29	

	Professional Electives					
Soft-core/ Semester	Course Code	Domain 1: System design and Networking	Course Code	Domain 2: Web Technologies	Course Code	Domain 3: Machine Learning and Data Science
PE-I/V sem	B20EFS511	System Programming	B20EFS513	Advanced IOT and Applications	B20EFS515	Artificial Intelligence and Applications
	B20EFS512	OOPs with C++	B20EFS514	OOAD	B20EFS516	Business Intelligence
PE-II/V sem	B20EFS517	Compiler Design	B20EFS519	C# and .net	B20EFS521	Web and Text Mining
	B20EFS518	Network Programming	B20EFS520	Multimedia Computing	B20EFS522	Deep Learning and Reinforcement Learning
PE-III/VI sem	B20EFS611	High Performance and Quantum Computing	B20EFS612	Advanced Web Technology	B20EFS613	Natural Language Processing
					B20EFS614	Digital Image Processing and Computer Vision
PE-IV/VI sem	B20EFS615	Advanced Topics in Networking	B20EFS617	Cloud Computing and DevOps	B20EFS618	Advanced Machine Learning
	B20EFS616	Cryptography and Network Security				
PE-V/VII sem	B20EFS711	Virtual and Augmented Reality	B20EFS712	UI/UX design	B20EFS713	Data Science Using R

OPEN ELECTIVES											
5TH SEM /OE-I			6th SEM /OE-II			7th SEM /OE-III			8th SEM /OE-IV		
Course code	Course Name	Teaching Department	Course code	Course Name	Teaching Department	Course code	Course Name	Teaching Department	Course code	Course Name	Teaching Department
B20CSO501	Database Management systems	CSE	B20CSO601	Data Structures	CSE	B20CSO701	Java Programming	CSE	B20CSO801	R Programming Language	CSE

List of Certification Programs:

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	Redhat: RHSCA in RedhatOpenstack
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	Kubernettes and RedhatOpenstack /AWS
VMWare: Certified Professional Cloud Management and Automation	Oracle: Business Intelligence	Oracle: Enterprise Management
Oracle: Virtualization	Redhat: Microservices 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

List of Skill Development Programs:

Skill Development Programs (by Clubs/Industries/Coporate-Trainers/Department-Faculty)		
Github and Open Source Technologies	Project Development Tools	Ethical Hacking
Cybersecurity and Forensics	Cyber Physical Systems	IOT and Cloud Convergence
Graphics with Open Source Tools	AR and VR with **Unit**y Software	Robotic Process Automation
Data Analysis using Python	Python and ML	Data Analysis with R
MongoDB and NOSQL	Jango 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
Andriod 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
Javascript for Cybersecurity	C++ Programming for Automotive Applicastions	E-commerce site design
Banking and Insurance using Python	MATLAB for Scientific Computing	Network Simulator NS3

I Year
Detailed Syllabus

I Semester
Syllabus

CourseTitle	Multivariable Calculus and Linear Algebra				CourseType	Theory	
CourseCode	B20AS0105	Credits	3		Class	ISemester	
Course Structure	TLP	Credits	Contact Hours	Work Load	TotalNumber of ClassesPer	Assessment in Weightage	
	Theory	3	3	3			
	Practice	0	0	0	Theory	CIE	SEE
	-	-	-	-			
	Total	**3**	**3**	**3**	**48**	**50**	**50**

COURSE OVERVIEW:

The course Differential Calculus deals with the basic aspects differential calculus. The students of Computer Science are equally benefited with this course as stepping stone to the broad areas of calculus. This course familiarize 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):

1. Explain the scalar and vector point functions and their operations.
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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	CourseOutcomes	POs	PSOs
CO-1	Apply Taylor's and Maclaurin's series for finding series expansions of functions and approximating values.	1,2,3	1
CO-2	Identify the curve forms and can evaluate the radius of curvature of the given curve.	1,2,3	1
CO-3	Evaluate the limit using L' Hospital rule after identifying an indeterminate form	1,2,3	1
CO-4	Solve the given system of equations by Gauss elimination and Gauss Jordon method, if the given system of equations is consistent.	1,2,3	1
CO-5	Determine the Eigen values, the corresponding Eigen vectors and diagonalize the given square matrix.	1,2,3	1

CO-6	Apply Rayleigh's Power method to find the largest Eigen value and the corresponding Eigen vector.	1,2,3	1

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO-1			√			
CO-2			√			
CO-3					√	
CO-4			√			
CO-5					√	
CO-6			√			

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3	1										1		
CO-2	3	3	2										1		
CO-3	3	2	1										1		
CO-4	3	3	1										1		
CO-5	3	3	1										1		
CO-6	3	2	1										1		

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

COURSE CONTENT

THEORY

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, Taylors 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/MAGAZINE:

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

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/107/111107108/

2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ma07/

3. https://nptel.ac.in/courses/111/106/111106051/

4. https://nptel.ac.in/courses/111/104/111104092/

5.https://nptel.ac.in/courses/111/104/111104085/

SELF-LEARNINGEXERCISES:

1. Vector spaces, Curvilinear co-ordinates: Cylindrical and spherical co-ordinates.

Course Title	Physics for Computer Science				Course Type	Theory	
Course Code	B20AS0106	Credits	3		Class	I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number ofClassesPer Semester	Assessment in Weightage	
	Theory	3	3	3			
	Practice	0	0	0	Theory	CIE	SEE
	-	-	-	-			
	Total	**3**	**3**	**3**	**39**	**50**	**50**

COURSE OVERVIEW:

This course introduces the basic concepts of Physics and its applications to Computer Science and 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.

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, 2, 3,	2
CO2	Solve and apply Schrodinger's time dependent and independent wave equations	1, 2, 3,	2
CO3	Analyse the working of LASERs and Classify EM waves based on the frequency range.	1,2,3	2
CO4	Classify optical fibres and derive expression for NA, number of Modes and attenuation.	1, 2, 3,	2
CO5	Summarize capacitive and resistive Display Technologies.	1, 2,3	2
CO6	Demonstrate the working of CRT and explain the application of quantum computation	1, 2,3	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	1											1	
CO2	3	2	1											1	
CO3	3	2	1											1	
C04	3	2	1											1	
CO5	3	2	1											1	
CO6	3	2	1											1	

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

COURSE CONTENT

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

REFERENCE BOOKS:

1. Charls Kittel, "Introduction to Solid State Physics", 8thEdition Wiley, Delhi,,2004
2. Arthur Beiser, "Concepts of modern Physics", 8th edition, Tata McGraw Hill publications,New Delhi, 2011
3. S. O. Pillai, "Solid State Physics", New Age International publishers, New Delhi, 2010
4. Janglin Chen, Wayne Cranton, Mark Fihn, "Handbook of Visual Display Technology", 2ndedition Springer Publication, 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/10.1088/176596/423/1/012027https://ieeexplore.ieee.org/document/4160250
4. 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		I Semester	
Course Structure	TLP	Credits	Contact Hours	WorkLoad	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	CIE	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 either by using MS-Excel/Python/R.

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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

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real world applications.	1 to 5, 8 to 10	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5, 8 to 10	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5, 8 to 10	1, 2, 3
CO4	Create the real world AI based solutions using different machine learning algorithms	1 to 5, 8 to 10	1, 2, 3
CO5	Illustrate modeling Error in Linear Regression	1 to 5, 8 to 10	1, 2, 3
CO6	Demonstrate applications of Data Science	1 to 5, 8 to 10	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 ARTICULATIONMATRIX

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

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

COURSE CONTENT

THEORY:

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 into Excel

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 visualizationusing 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>sl.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.
<table>
<tr><td>Plot the graph. Hgt of Fathers</td><td>158</td><td>166</td><td>163</td><td>165</td><td>167</td><td>170</td><td>167</td><td>172</td><td>177</td><td>181</td></tr>
<tr><td>Hgt of Sons</td><td>163</td><td>158</td><td>167</td><td>170</td><td>160</td><td>180</td><td>170</td><td>175</td><td>172</td><td>175</td></tr>
</table></td><td>MS Excel</td><td>Create and perform operations on Excel data set by applying Linear regression</td></tr>
</table>

<table>
<tr>
<td>2.</td>
<td>Using the data file DISPOSABLE INCOME AND VEHICLE SALES, perform the following:
i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trendline feature).
iv) Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900.
v) 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.
i) Plot a scatter diagram.
ii) Determine the regression equatine (hint: use MS Excel's Add Trendline feature).
iii) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
iv) 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 dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.
<table>
<tr><th>year</th><th>month</th><th>interest rate</th><th>unemployment rate</th><th>stock index price</th></tr>
<tr><td>2020</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr>
</table>
</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.
<table>
<tr><th>Sl No.</th><th>A</th><th>B</th></tr>
<tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr>
<tr><td>2</td><td>Annual interest rate</td><td>5.20%</td></tr>
<tr><td>3</td><td>Year of the loan</td><td>3</td></tr>
<tr><td>4</td><td>Starting payment number</td><td>1</td></tr>
<tr><td>5</td><td>Ending payment number</td><td>36</td></tr>
<tr><td>6</td><td>total interest paid during period</td><td>?</td></tr>
</table>
</td>
<td>MS Excel</td>
<td>Create Excel data and perform EMI estimator</td>
</tr>
</table>

<table>
<tr><td>6.</td><td>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.</td><td>SQL</td><td>Creating Tables</td></tr>
<tr><td>7.</td><td>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 customers details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.</td><td>SQL</td><td>Creating and retrieving Tables</td></tr>
<tr><td>8.</td><td>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.<table><tr><td>CITY</td><td>Temperature in Centigrade</td><td>Rain in Centimeters</td></tr><tr><td></td><td></td><td></td></tr></table></td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>9.</td><td>Use the linear regression technique to compare the age of humans with the amount of sleep in hours.<table><tr><td>Name</td><td>Age in Years</td><td>Sleep in hours</td></tr></table>Create your own database with above details.</td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>10.</td><td>Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.</td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>11.</td><td>Design the ER diagram and create schema of the REVA library management system.</td><td>Entity Relationship</td><td>Entity Relationship diagrams</td></tr>
<tr><td>12.</td><td>Design the ER diagram and create schema for Hospital Management system.</td><td>Entity Relationship</td><td>Schema design</td></tr>
</table>

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”,43rdedition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, “Database Management systems”, 3rdEdition, 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”, 19th edition,Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, “Advanced Engineering Mathematics”, 9th edition,Wiley Publications, 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/41060International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253IEEE Magazine on Big data and Analytics

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNINGEXERCISES:

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

<table>
<tr><td>Course Title</td><td colspan="3">Programming for Problem Solving</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20CS0102</td><td>Credits</td><td colspan="2">4</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>
<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 rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></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:

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.

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate knowledge on C programming constructs to develop programs.	1-5,9,10,12	1, 2
CO2	Apply functions and Arrays to enhance reusability and data manipulation.	1-5, 9,10,12	1,2
CO3	Use pointers to manage the memory effectively.	1-5, 9,10,12	1, 2
CO4	Demonstrate the use of command line arguments for a given problem.	1-5, 9,10,12	1,2
CO5	Apply Structures, Unions and File handling concepts to develop societal applications.	1-6, 9,10,12	1, 2
CO6	Design algorithms using problem-solving techniques for given problems.	1-5, 9,10,12	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 ARTICULATIONMATRIX

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

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

COURSE CONTENTS

THEORY:

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

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.

UNIT – 2

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.

Arrays: one dimensional array, two dimensional array, Linear and binary search and bubble sorting.

UNIT – 3

Pointers: Introduction to pointers.

Strings: string operations with and without using inbuilt string functions.

Functions: Structure of a function, types of functions, parameter passing mechanisms, Command line arguments.

UNIT – 4

Structures & Union: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, union, typedef.

File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions, File Positioning Functions, Error Functions.

PRACTICE:

Part-A

Sl. No.	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
1	a.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 <10 lpa, high:>10lpa) .	If then and else/ Switch case	Develop application program using if-else and switch
	b. 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 put in the third file. Display the contents of DATA.	Files, Merging	Develop application program using Files
2	a.Display the right angle, isosceles and equilateral triangles , comprising of alphabets from A to Z (upper case) in the following format	Nested Loops	Develop application program using Nested Loops
	b.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”.	structures, loop, search technique	Develop application program using Structure
3	a.Assume that Mr. Peterson shopped n items at big market and the 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	Structure, Linear Search	Develop application program using Structure and Linear Search

	spent on shopping at Big Market and also find out the item with minimum and maximum cost.		
	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	Develop application program using Nested Structures
4	a.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.	Structure, Array, Loops	Develop application program using array of Structures.
	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.	Structure, User-defined functions	Develop application program using array of Structures and functions,
5	a.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.	Array of, Structures, loops, Bubble Sort	Develop application program to sort the contents of structure.
	b.Write a C program to compute the monthly pay of "N" employees using each employee's name, Basic_Pay, DA, 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.	Structure, loops	Develop application program using structure
6	Consider the details of "N" Faculty members consisting of Name, EMP-ID,name of the department, address and salary. Create a file to store the above details. Retrieve the contents of the file to perform following operations: isplay the details of the faculty based on salary range entered. (ii) Display the details of the faculty based on the EMP-ID entered.	File and looping concepts	Develop application program using Files.
	b.A character is entered through keyboard. 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.	if statement	Develop application program using if-statement..

Part-B

Sl. No.	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Develop a project for Address Contact List with the following modules: 1. User a. Add User(Name, Address, Primary contact number, secondary contact number, E-mail ID) b. Delete User c. Search for User 2. Edit a. Find and replace the user name b. Edit the contact (Phone Number) details. c. Edit the Address of the user		

	3. Report a. List of users based on the starting letter of their names. b. List of users based on first 2 digits of their mobile number. c. List of users based on the domain name of their E-mail ID. **Title: Contact List / Address Book** **Problem Definition:** It is quite difficult to remember every person's address and mobile numbers. Hence, it is required to build an address book / contact list to store name, address, phone number and email_id. The contact book should provide the options for adding, deleting and editing the user's data. It should also have provision for searching the users data. **Solution:** **Develop a project to implement a contact list with the following modules:** 1. User a. Add member b. Delete member c. Search for member 2. Transaction a. Find and replace the user name b. Edit the contact (Phone Number) details. c. Edit the Address of the user 3. Report a. List of users based on the starting letter of their names. b. List of users based on first 2 digits of their mobile number. c. List of users based on the domain name of their E-mail ID. Implementation: Consider the following functions with data members for developing the address book / contact list. 1. Structure: Contact a. Attributes :username, address, mobile,phone1,email_id b. Functions: add_member, delete_member, edit_member, search_member, find_member. 2. Report: Functions: List the users details based on name, mobile numbers, and email id.		
	List of Experiments:		

Sl.No	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
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”.	Structure, arrays, &files	1. 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.	Structure, arrays, &files	2. Develop the program using Structures and Files
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.	Structure, arrays, &files	3. 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.	Structure, arrays, &files	4. Develop the program using String and File
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.	Structure, arrays, &files	5. 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.	Structure, arrays, &files	6. 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 “.	Structure, arrays, &files	. 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”.	Structure, arrays, &files	8. 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.	Structure, arrays, &files	9. Develop the program using file
	Project : Calculator **1. Arithmetic Operations:** a. Addition b. Subtraction c. Multiplication d. Division **2. Relational Operations:** a. Less Than b. Greater Than c. Less Than or Equal to d. Greater than or equal to e. Equal to f. Not Equal to		

	3. Mathematical Operations: a. Exponentiation b. Power c. Sine d. Cosine		
	Title: **Simple Scientific Calculator** **Problem Definition:** A calculator is a simple device which takes one or two inputs and performs the operations like arithmetic, logical, relational and Mathematical depending upon the operation chosen by the user. It is required to simulate the calculator to implement the above operations. **Solution:** **Develop a project to implement a simple scientific calculator with the following modules:** **1. Arithmetic Operations:** a. Addition b. Subtraction c. Multiplication d. Division **2. Relational Operations:** a. Less Than b. Greater Than c. Less Than or Equal to d. Greater than or equal to e. Equal to f. Not Equal to. **3. Mathematical Operations:** a. Exponentiation b. Power c. Sine d. Cosine **Implementation:** Consider the working of a calculator. It should take in two input and an operation like +,- etc. Calculate the resultant with the input given. **Ex:** if the input is 2 + 3 then it should give an output 5.		

Sl.No	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Develop a program in C using if- else statement to perform the mathematical operations like like addition, subtraction, multiplication and division on any two operands and display the results of the same based on the choice entered by the user.	If else ladder	Develop the program using if-else to implement arithmetic calculator
2	Develop a program in C using switch statement to perform logical operations like Less Than, Greater Than, Less Than or Equal to, Greater than or equal to, Equal to, Not Equal to on any two operands get the result of the same based on the choice entered by the user.	Switch	
3	Develop a program in C using switch statement to perform mathematical functions like Exponentiation, Power, Sine, Cosine and get the result of the same based on the choice entered by the user.	if-else-ladder	

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", 2ndedition,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", 2nd edition, PearsonEducation, 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/1267572IEEE 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-LEARNINGEXERCISES:

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	Entrepreneurship				Course Type		Theory	
Course Code	B20ME0104	Credits	1		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per 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 introductory course is designed to introduce you to the foundational concepts of entrepreneurship, including the definition of entrepreneurship, the profile of the entrepreneur, 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(S):

1. To understand the basic terms, concepts in Entrepreneurship Development
2. To analyze and 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	Define the keywords and concepts used in entrepreneurship development	1	
CO2	Describe the characteristics and types of an entrepreneur	1,6	1,3
CO3	Explain the new generations of an entrepreneurship and skills of an entrepreneur	1,2,6,7,10,12	1,3
CO4	Differentiate between the industrial park and special economic zone	1,2,7	1,3
CO5	Classify the tender process and exemptions from income tax.	1,2,5,8,10-12	1,3
CO6	Choose the suitable government agencies to support his/her idea to become an entrepreneur	1-4,6-12	1,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

	Bloom's Level

CO#	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	1														
CO2	1					1							2		2
CO3	1	1				2	1			1		2	2		2
CO4	1	1					2						2		2
CO5	2	2			1			3		3	3	1	2		2
CO6	1	3	3	1		3	3	3	1	3	3	2	2		2

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

COURSE CONTENTS
THEORY:

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

TEXTBOOKS:

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,"Entrepreneurship in the New Millennium", Cengage Learning India Pvt LTD.

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-LEARNINGEXERCISES:

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.

<table>
<tr><td>Course Title</td><td colspan="4">IoT and Applications</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20EC0101</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">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>1</td><td>1</td><td>1</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</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>2</td><td>3</td><td>3</td><td>13</td><td>26</td><td>50</td><td>50</td></tr>
</table>

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 .

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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	Develop simple IoT projects and modules	1,5,9, 12	1,2
CO6	Identify technologies used to develop IoT based applications	1, 5, 9,10,11,12	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 ARTICULATIONMATRIX

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				3				2			3	3	3	
CO6	3				3				2	2	2	3	3	3	

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

COURSE CONTENT

THEORY:

UNIT – 1

IoT Basics: Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages and Disadvantagesof 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 – 2

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:

Sl. No.	Titleof theExperiment	Tools and Techniques	ExpectedSkill /Ability
	Part-A		
1.	Introduction to IoT Board a. Arduino UNO b. Arduino Nano c. Node MCU d. Ethernet Shield	Hardware	• Identifications of various parts of Arduino and Node MCU boards • Study of Ethernet shield and connection to the board
2.	Working with Arduino IDE (Integrated Development Environment)	Open source Arduino IDE	• Download specified software • Modify code as per the application
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 Colour 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 detection.
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

Part-B (Case Study projects)		
Automated lighting system IoT and Cloud Server Based Wearable Health Sensor's Monitoring System intelligent Traffic system Motor Controlling with Android App A Smart System connecting E-Health Sensor's and the Cloud IoT based Garbage Management System , IoT based submersible motor pumps on/off IoT Based Electronic Door Opener, IoT Based Garbage Monitoring Building Automation System Using GRPS IoT, Implementation of Industrial Data Acquisition, management and Guiding using IoT Distance based Accident Avoidance System using CAN protocol & Tracking through IoT , Swachh Bharat Waste Collection	Smart Parking Smart healthcare IoT - Industrial Internet of Things Monitoring Of Sensor's Data on Android App Integrated Smart Health Care Monitoring System Smart E-Agriculture Monitoring Using Internet Of Things Smart Home Automation using IOT Monitoring of Highway Hybrid Parameter & Controlling Highway Light Through IoT IoT Based Smart Agriculture Monitoring System IoT Based Agriculture Crop - Field Monitoring System and Irrigation Automation Multiple Garbage Box Monitoring & Collection system IoT Based Garbage Monitoring System	Smart water management IoT for smart cities Remote Patient Monitoring ,E Agriculture Monitoring on Webpage Air Pollution & Water Quality Monitoring System An IoT Based PatientMonitoring System using RaspberryPi,Underground Cable Fault Detection Over Internet Of Things (Iot) Google Map IoT Air & Water Quality Monitoring System,IoT Based Automatic Vehicle Accident Detection and Rescue System Patient Health Status Observing Based On IoT and Email Alert IoT Based Vehicle Accident Detection and Tracking System on google map webpage Data Logger System for weather monitoring using WSN ,Smart intelligent security system for women

PART C (Mini Project)			
1	**Arduino Controlled Light intensity**: design and build a simple , effective circuit called Auto Intensity Control of Street Lights using Arduino	ArduinoUNO,DS3231 RTC Module, LDR 16×2 LCD Display ,LED,10KΩ Potentiometer,10KΩ Resistor, Push Button, Connecting Wires, Breadboard	Design and Implementation of IoT project to solve Engineering Problems.
2	**Thermometer**: build an LCD thermometer with an Arduino UNO and a LM35/36 analog temperature sensor.	Arduino Uno, Temperature Sensor, LCD display, Breadboard and Connecting wires	Design and Implementation of IoT project for Engineering applications.
3	Motion activated light lamp: build an automated project that It switches on and off when there's motion.	Arduino Uno, PIR Motion sensor, breadboard, connecting wires, LED generic.	Design and Implementation of IoT project for Engineering applications

TEXTBOOK:

1. Vijay Madisetti, ArshdeepBahga,"Internet of Things: A Hands-On- Approach ", Secondedition2014,ISBN: 9780996025515.

.

REFERENCEBOOKS:

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-LEARNINGEXERCISES:

1.Create Arduino project hub

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
	-	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	1
CO2	Draw orthographic projection of point, line, plane surfaces and simple solids	1,3,5, 10	1
CO3	Draw orthographic projection of simple solids	1,3,5, 10	1
CO4	Draw sectional views of a prisms, pyramids, cone and cylinder	1,3,5, 10	1
CO4	Develop the lateral surfaces of the solids	1,2, 3,5,10	1,2,3
CO6	Create isometric view of the solids	1,3,5,10	1,2,3

BLOOM'S LEVELOF 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		
CO2	3		2		3					3			3		
CO3	3		2		3					3			3		
CO4	3		2		3					3			3		
CO5	3	2	2		3					3			3	3	2
CO6	3		2		3					3			3	2	1

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

COURSE CONTENT

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", 11th Edition PHI, 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/

II Semester
Syllabus

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	0	0	0	Theory	CIE	SEE
	-	0	-	-			
	Total	**4**	**4**	**4**	**48**	**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 Quickselect.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 OBJECTIVE (S):

1. Describe Curve fitting and regression in various problems in Computer Science and engineering fields.
2. Illustrate the applications of Probability and statistics in various computer science and engineering Fieldslike data mining, classification problems etc
3. Discuss Sampling theory concepts to solve various engineering problems likestructured and unstructured data models
4. Demonstrate Stochastic problem as Markov model as a problem solving methodsfor systematic model buildings.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO-1	Solve the problems of Curve fitting and regression in various problems in Computer Science and Engineering fields.	1,2,3	1
CO-2	Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.	1,2,	1
CO-3	Develop a stochastic problem as Markov model as a problem solving methods for systematic model buildings.	1,2,3	1

CO-4	Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.	2,3	1
CO-5	To use Discrete time Markov chain to model computer systems.	1,3	1
CO-6	To expose the basic characteristic features of a queuing system and acquire skills analyzing queuing models.	2,3	1

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	3	2										3		
CO2	3	3											3		
CO3	3	3	2										2		
CO4		3	2										1		
CO5	2		2										1		
CO6		3	1										2		

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

COURSE CONTENT
THEORY:

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.

Introduction to queuing systems: Single queuing nodes, service disciplines, M/M/1 Queuing system.

TEXTBOOKS:

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

REFERENCEBOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", 19th Reprint edition,Tata McGraw Hill Publications, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics",4th edition,Narosa Publishing House, 2016.
3. V.Sundarapandian, "Probability, Statistics and Queueing 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",5thedition, Macmillan publishers, ,2013.

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-LEARNINGEXERCISES:

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

Course Title	**Engineering Chemistry**	**Course Type**	**Theory**

Course Code	B20AS0104	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				Theory	CIE	SEE
	Tutorial						
	Total	**3**	**3**	**3**	**39**	**50**	**50**

COURSE OVERVIEW:

Engineering chemistry covers very relevant topics compatible with ECE, EEE and CSE 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 (S):

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

Engineering chemistry covers the very basic knowledge required for engineering students to understand its importance of Science in technology.

1. It provide the basic knowledge on Interaction of light and matter to know the electronic transitions in materials and storage and conversion devices.
2. 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
3. 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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the phenomenon of light and matter interaction to study the materials	1,2,3	1
CO2	Illustrate the method of preparation of solar grade silicon and effect of dopant in photovoltaic devices.	1,2,3	1
CO3	Describe Corrosion phenomenon and precautions to be taken in the selection of materials in controlling corrosion. Methods of fabrication of printed circuit boards (PCB) and industrial applications.	1,2,3	1
CO4	Illustrate the properties of polymers, nano materials, composite materials and their applications in various fields.	1,2,3	1
CO5	Explore the light interaction with matter, modern materials and their composites for technological applications	1,2,3	1
CO6	Suggest the advanced materials for electrochemical energy storage, conversion, and environmental remedies.	1,2,3	1

BLOOM'S LEVELOF THECOURSE 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	3	2	1										1		
CO2	2	1	2										1		
CO3	1	2	1										1		
CO4	2	3	3										1		
CO5	2	2	2										1		
CO6	1	2	1										1		

COURSE CONTENT

THEORY:

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 – photo physical 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-MnO_2) 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 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 and Metal Finishing

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.

UNIT – 4

Chemistry of Engineering Materials

Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in poly acetylene and poly aniline. Liquid crystals: **Introduction** classification and applications in electronic display devices. Nano materials: 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 bio electronic applications.

TEXTBOOKS:

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/

Course Title	**Introduction to Python Programming**				**Course Type**	**Integrated**
Course Code	**B20CI0101**	**Credits**	**3**		**Class**	**I/II Semester**
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes	Assessment in

Course Structure	Theory	2	2	2	Per Semester		Weightage	
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of language constructs to solve real world problems using python programming.	1,2,3	1
CO2	Develop programs for text processing and other application domains by making use of regular expressions.	1,2,3	2
CO3	Apply features of object oriented and NumPy package to develop computationally intensive programming to analyze and interpret the data.	1,2,3,4	2,3
CO4	Create data science solutions with the help of files, Pandas and Data Visualization.	1,2,3,4,5	1,2,3
CO5	Develop sustainable solutions/projects for the needs of society, organizations and other sectors.	7,11	1,2,3
CO6	Recognize the need and engage in learning new libraries and tools in python.	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	3	1	3										3		
CO2	3	2	3									1		3	
CO3	3	1	2	1										3	2
CO4	3	2	3	2	2								3	3	2
CO5							3				2		3	3	2
CO6												2			2

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

COURSE CONTENT

THEORY:

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, Jupyter	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. i) Convert all the strings to uppercase and display ii) 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: 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		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: 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".	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: 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)	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, DEPARTMENT_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 deletion.	Windows/Linux OS, IDE, Jupyter	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.	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, DEPARTMENT_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".	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" and display the contents of 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_dateare 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 regular expressions.
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/Linux OS, IDE, Jupyter	Module integration and project development.

TEXTBOOKS:

1. Mark Pilgrim, "Dive into Python 3",2nd edition,Apress special edition, 2015.
2. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers,2006.

REFERENCEBOOKS:

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",2nd Edition New Riders, 2002. Springer,".
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
5. Python for scientific computing

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-LEARNINGEXERCISES:

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

Course Title	Basic Electrical & Electronics Engineering				Course Type		Integrated	
Course Code	B20EE0101	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	1	Theory Hours	Practical Hours	CIE	SEE
	-	0	-	-				
	Total	**4**	**5**	**4**	**39**	**26**	**50**	**50**

COURSEOVERVIEW:

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 datafor 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	1,2
CO2	Analyze the concepts and applications of DC & AC Machines.	1-5	1,2
CO3	Apply the concept of domestic wiring, importance of safety and sensing devices	1-5,10	1,2
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	1,2
CO5	Interpret, Identify and use appropriate electrical tools for electrical connections and to repair electrical equipment's.	1,4	1,2
CO6	Compare experimental results with theoretical analysis and the ability to critically evaluate the performance of electrical appliances.	1,5	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	3	3	1	2	1							1	1	1
CO2	2	3	2	2	1								1	1	1
CO3	2	2	2	2	1					2			1	1	1
CO4	3	3	3	1	1								1	1	1
CO5	2	2	1	3	1	3	1		3	1			3	3	3
CO6	3	2	1	3	1	3	1		3	1			3	3	3

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

COURSE CONTENT
THEORY:

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 andSensors: 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.	Trainer kit Ohms Law Fall of resistance	Importance & applications of Earthing, Fuse & MCB
	b) To conduct experiment and to know the Importance and mechanism of FUSE		
	c) To study the Importance and mechanism of MCB.		
2.	Home Electrical Wiring Demonstration. a) To study & verify the connection procedure for fluorescent lamp wiring.	Fluorescent Lamp wiring Panel Fan with switch and regulator Kit	Connection & Trouble shooting of Fluorescent lamp wiring & Fan with switch and regulator
	b) To study the connection of 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.	Series and parallel circuits Kit	Connection &behaviour of current & voltage in series , parallel circuit
	b) To study and verify the behaviour of current and voltage in parallel circuit.		
5.	Polarity test on single phase transformer. a)To determine the additive polarity of a single-phase transformer.	Transformer Kit	Polarities of single phase transformer
	b) To determine the subtractive polarity of a 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 of rectifiers
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 Source	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", 3rd edition Tata McGraw Hill, 2009.
2. Hayt and Kimberly, "Engineering Circuit Analysis", 8thEdition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., "Basic Electrical Engineering", Tata McGraw Hill, 2009.
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI, India, 2009.
5. Hughes, E., "Electrical Technology", Pearson, 2005.
6. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5thedition, 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, Systems",5thedition, Pearson 2007.
2. Hughes, "Electrical Technology", International Students 9thedition, 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 a electrical circuit using BJT as a switch
2. Identifying the practical application of Electromagnetic Induction

Course	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	CIE	SEE
	Tutorial	0	-	-				
	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(S):

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

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	Calculate the speed ratio of belt drives and Gear Drives.	1,2,3	3

CO4	Describe the moment of force and couples and equivalent force-couple system.	1,2	3
C05	Solve numerical problems on composition of coplanar concurrent and non-concurrent force system.	1,2	3
CO6	Describe the basic terminology fluid mechanics	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		✓				
C05			✓			
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
CO2	3	2													1
CO3	3	2	3												1
CO4	3	2													1
C05	3	2													1
C06	3	2													1

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

COURSE CONTENT

THEORY:

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

torefrigeration 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 soldering, Applications and safety tools

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 concurrent forces.

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”, 12thEdition, 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 “,4thedition, Pearson India, 2007.

REFERENCE BOOKS:

1. SKH Chowdhary, AKH Chowdhary, NirjharRoy(2001),"The Elements of Workshop Technology - Vol I & II, 11th edition, Media Promotors and publisher.
2. Avikshit Saras, "3D Printing-Made Simple", BPB Publications.

JOURNALS/MAGAZINES:

1. 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-2-008x/
3. https://www.coursera.org/learn/3d-printing-applications

Course Title	Biology For Engineers				Course Type	Theory	
Course Code	B20AS0109	Credits	1		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	-	-	-	Theory	CIE	SEE
	Tutorial	-	-	-			
	Total	**1**	**1**	**1**	**13**	**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 OBJECTIVE(S):

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#	CourseOutcomes	POs	PSOs
CO1	Understand and explain the concepts regarding origin and evolution of life.	1	
CO2	Demonstrate the structure and functions of various biomolecules in living system.	1	
CO3	Comprehend the organization of cell structure in prokaryotes and eukaryotes.	1	
CO4	Describe the process of cell division involving mitosis and meiosis	1	
CO5	Predict the inheritance pattern of genes from parents to offspring	1	
CO6	Apply the principles of Biology either for the process/product development from the engineering perspective.	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	PSO2
CO1	2														
CO2	2														
CO3	2														
CO4	2														
CO5	2														
CO6	2														

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Biology, Evolution and Origin of Life, Biomolecules-Lipids, Biomolecules: Carbohydrates, Water Biomolecules: Amino acids, Proteins, Biomolecules: Enzymes.

UNIT – 2

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.TanuAllen, “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”,S. Chand Publishing,2018.
2. Sambamurthy,”Handbook of Genetics”, Friends Publisher, 2010

JOURNALS/MAGAZINES:

1. Current Sciences

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNING EXERCISES:

Case Study: Computational biology in agriculture and Health Care Artificial Intelligence in health care Image processing for medical applications

Course Title	Design Thinking				Course Type		Integrated	
Course Code	B20ME0102	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
	Total	**2**	**3**	**3**	**13**	**26**	**50**	**50**

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(S):

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	Develop empathy maps to visualize user needs and to get insights of the problem.	1,2,9,10,12	2
CO3	Define the problem from user's perception.	1,2,9,10,12	1,2
CO4	Apply Ideation techniques to ideate innovative ideas for the problem	1,2,9,10,12	1,2
CO5	Develop simple prototypes for problems using feasible idea.	1,3, 5,9,10,12	1,2
CO6	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

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	1	2							3	2		3	1	2	
CO4	1	2							3	2		2	1	2	
CO5	2		3		2				3	3		2	2	3	
CO6	2			2				1	3	2		2	2	3	

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

COURSE CONTENTS

THEORY:

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/

2nd Year Detailed Syllabus

III sem syllabus

Course Title	Analog and Digital Electronics				Course Type		Integrated	
Course Code	B20CS0301	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:

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. Demonstrate the use of general electronic instruments in design and testing of digital logic circuits.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in rectifiers, filter circuits and wave shaping	1 to 4,7,8,9,10,12	1
CO2	Apply the basic knowledge used in solid state electronics including diodes, and operational amplifiers for specific engineering applications.	1 to 3, 5, 7,8,9,10,12	1
CO3	Identify the different families of digital integrated circuits build, and troubleshoot combinatorial circuits using digital integrated circuits	1 to 5, 7,8,9,10,12	2
CO4	Develop the ability to analyze and design analog electronic circuits using discrete components	1,4,5, 7,8,9,10,12	3
CO5	Model the schematics of some electronic circuits to interpret its working.	1,3,5, 7,8,9,10,12	3
CO6	Solve the implementation of logic circuit using programming.	1,2,4, 7,8,9,10,12	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	3	1	1	2			2	2	3	3		2	3		
CO2	3	2	3		2		2	2	3	3		2	3		
CO3	3	1	2	1	2		1	2	3	3		2		3	
CO4	3			2	2		1	2	3	3		1			3
CO5	3		2		2		1	2	3	3		1			3
CO6	3	3		2			1	2	3	3		1			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,fullSubtractor,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

TEXTBOOKS:

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.

REFERENCEBOOKS:

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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	B20CI0301	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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5,9,10,12	1,3
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5, 9,10,12	1,3
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5, 9,10,12	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 9,10,12	2
CO5	Apply the garbage collection for saving the resources automatically in real world problem.	1 to 5, 9,10,12	1,3
CO6	Develop java web applications using JDBC in real world problem.	1 to 5, 9,10,12	1,3

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	3	3	2	2	1				3	3		2	3		3
CO2	3	3	2	2	1				3	3		2	3		3
CO3	3	3	1	1	1				3	3		2		3	3
CO4	3	3	3	1	2				3	3		2		3	
CO5	3	1	2	1	3				3	3		2	3		3
CO6	3	1	2	1	3				3	3		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.The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database.

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 smaller than or equal to n.	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 JAVA program to solve a given set of linear equations.	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: $x_i = \frac{x_{i-1} + (a/x_{i-1})}{2}, i = 2, 3, \ldots$ Develop a JAVA application that implements the above SQRT function to compute the square root of any positive	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: • create a lamp object; • turn it on and off; • print the lamp's on/off status to the console.	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 theaddition, subtraction, multiplication and division operations.
		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 Case function as a parameter to the sort function using method reference. Print the sorted array.	Windows/Linux OS, IDE	Creation of string class and its usage

7	XYZ technologies is firm that has 5employees with 1manager, 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 inheritance, where Employee is an abstract class and Manager and Technician are derived from Employee. Demonstrate a polymorphic behavior for giving the annual increments.	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 try/catch blocks, and prints either the output of halfOf() or the caught Odd Exception.	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 and also handle divide by zero using java exception handling mechanism.	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 10students and reverse the list. Print the details before and after reversing the collection.	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.

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1. Cay S. Horstmann, "Core Java® SE 9 for the Impatient", Addison Wesley, Second Edition, 2018.
2. HerbertSchild, "Java™:TheCompleteReference",McGraw-Hill, TenthEdition,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.

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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-LEARNINGEXERCISES:

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	B20CS0302	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:

This course covers basic data structures techniques and their implementation in Java. Familiarize the concept of Abstract Data Types (ADT), stacks, Queues and Trees. The course also introduces applications of these data structures in solving problems. Students are expected to use these data structure concepts to write simple programs.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain the basic Concepts of java and Data Structures

2. Illustrate the creation and use of singly and doubly Linked list in Java.

3. Demonstrate the use of Stacks and Queues in real world applications.

4. Discuss the concept and applications of Binary trees.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Java Arrays to solve real world problems.	1 to 5,9,10,12	1
CO2	Develop a java program for implementing the linked list.	1 to 5, 9,10,12	1,2
CO3	Build a real world application in Java using stacks and queues.	1 to 5, 9,10,12	1,2
CO4	Apply the concepts of trees for solving real world problems.	1 to 5, 9,10,12	1,2
CO5	Identify the most suitable data structure for real world application.	1 to 5, 9,10,12	1,2,3
CO6	Experiment with all data structures in a high-level language for problem solving.	1 to 5, 9,10,12	1,2,3

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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Data Structures: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms; Arrays-Sorting an Array (Insertion Sort), java.util Methods for Arrays, Cryptography with character arrays; Two-dimensional Arrays and positional games.

UNIT – 2

Linked list: Singly Linked List, Implementing a Singly linked list class; Circularly Linked List, Round-Robin Scheduling, Designing and implementing a circularly linked list; Doublylinked List, Implementing a Doubly linked list class.

UNIT – 3

Stacks: Introduction, The Stack Abstract Data type, A Simple Array-based Stack implementation, Implementing a Stack with a Singly Linked List.

Queue: Introduction, The Queue Abstract Data type, Array-based Queue implementation, implementing a Queue with a Singly Linked List.

UNIT – 4

Trees: General Trees-Tree definitions and properties, The Tree Abstract data type, computing depth and height; Binary Trees: The Binary Tree abstract data type, properties of Binary Trees; Implementing Trees- Linked structure for Binary Trees; Tree Traversal Algorithms- Preorder, Postorder Traversals of General Tree, Inorder Traversal of a Binary Tree, Implementing Tree Traversal.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	Matrix multiplication is thus a basic tool of linear algebra, and as such has numerous applications in many areas of mathematics, as well as in applied mathematics, statistics, physics, economics,and engineering. Co mputing matrix products is a central operation in all computational applications of linear algebra. Write a Java program using the data structure arrays to multiply two given matrices of same order.	Windows/Linux OS, IDE	Creating an array and performing some operations on array
2.	A Sparse matrix is a matrix with the majority of its elements equal to zero. Develop a program in java to read a sparse matrix of integer values in the 2D array format and convert the sparse matrix to <row, column, value> format and search for an element specified by the user. Print the result of the search appropriately.	Windows/Linux OS, IDE	Creating an array and performing some operations on array.
3.	The abstract datatype (ADT) is special kind of datatype, whose behavior is defined by a set of values and set of operations. Stack is a linear data structure which follows a particular order in which the operations are performed. The order may be LIFO(Last In First Out) or FILO(First In Last Out). Write Java programs to implement the STACK ADT using an array.	Windows/Linux OS, IDE	Creating a stack data structure and performing some operations on it.
4.	Whenever we need to manage any group of objects in an order in which the first one coming in, also gets out first while the others wait for their turn, like in the scenarios of Serving requests on a single shared resource, like a printer, CPU task scheduling etc., we need a Queue Data Structure. Write Java programs to implement the QUEUE ADT using an array.	Windows/Linux OS, IDE	Creating a queue data structure and performing some operations on it.

5.	Infix expressions are readable and solvable by humans. We can easily distinguish the order of operators, and also can use the parenthesis to solve that part first during solving mathematical expressions. The computer cannot differentiate the operators and parenthesis easily, hence postfix conversion is needed. Select an appropriate data structure and develop a program to convert an infix expression into postfix using stack.	Windows/Linux OS, IDE	Understanding Expression conversions by using stack data structure
6	These are few operations or functions of the Stack ADT. isFull() used to check whether stack is full or not, isEmpry() used to check whether stack is empty or not, push(x) used to push x into the stack, pop() used to delete one element from top of the stack, peek() used to get the top most element of the stack, size() is used to get number of elements present into the stack Write Java programs to implement the STACK ADT using a singly linked list.	Windows/Linux OS, IDE	Creating a stack data structure and performing some operations on it.
7	Evaluation of postfix expressions is done by compilers during the compilation process. Design and Develop a program to evaluate a postfix expression using stack.	Windows/Linux OS, IDE	Understanding Expression conversions by using stack data structure
8	The queue operations are given as Queue() creates a new queue that is empty. enqueue(item) adds a new item to the rear of the queue. dequeue() removes the front item from the queue. isEmpty() tests to see whether the queue is empty. size() returns the number of items in the queue. Write Java programs to implement the QUEUE ADT using a singly linked list.	Windows/Linux OS, IDE	Creating a queue data structure and performing some operations on it.
9	Consider a compiler, Matching parentheses ('(' and ')'), brackets ('[' and ']'), and braces ('{' and '}') delimit various parts of the source code. In order for these parts to be interpreted correctly, the compiler must be able to determine how these different kinds of parentheses match up with each other. Write a java program that determines whether parenthetic symbols ( ), { } and [ ] are nested correctly in a string of characters (use stack ADT).	Windows/Linux OS, IDE	Creating a stack data structure and performing some operations on it.
10	The researches about biological sequence compression algorithms use palindrome. Write a java program that uses both stack and queue to test whether the given string is a palindrome (Use Java Utility).	Windows/Linux OS, IDE	Usage of stack and Queue data structure
11	Files are stored in memory in tree structure directory. Design and develop a program to create a directory having files with unique file-id in the hard disk and display the files in all three traversal orders using Binary Search Tree (BST).	Windows/Linux OS, IDE	Creating a tree data structure and performing some operations on it.
12	Consider a class having 100 students where, the details of each student like name, roll number and marks of 3 subjects is to be stored. Design and develop a program to construct a singly linked list to enter records of different students in list, display the list and calculate the percentage of each student. Also count the number of students passed (scored >40 in all the subjects).	Windows/Linux OS, IDE	Creating a linked list data structure and performing some operations on it.
	Part-B (Mini Project: Text Editor Design)		

	A text editor is a program that allows the user to open, view, and edits plain text files (files containing only text). They are essential to the world today as lots of people often try to open a text file and view the content. Most of us have interacted or heard of text editors such as Notepad, Vim, gedit, and so on. Text editors have evolved over time to become faster and provide more features than their competitors. Text editors deal with manipulating text and provide features to enhance the experience. The major functionalities of text editors are: inserting, deleting, and viewing text. Additional features that are practically required to even compete with other text editors are: find and replace, copy/cut and paste, text formatting, sentence highlighting, and etc. In this context, create a text editor(without GUI) using various data structures in JAVA language that allow user to create/edit/save text files and allow user to perform the following operations using various suitable data structures.		
	File Module		
1	It is required to store the brief profile of the 10 students permanently in the file "Student.txt". Develop a program to implement the above task.	File, loop	Able to create the text file
2	It is required to append the "Student.txt" with details of some more students. Develop a program to achieve the above goal.	File, String,	Able to write into text file
3	It is required to open the "Student.txt" and display the contents. Develop a program to achieve the above goal.	File	Able to open and view contents of the text file
4	Search for a file It is required to search a file name "Student.txt" among all the existing files, if file exists, display the contents of the file. If file does not exist, display the message "file not found". Develop a program to achieve the above goal using file system.	Binary search tree	Able to search and view contents of the text file
	Edit Module		
5	It is required to open the file "Student.txt" and display the contents. Further, a portion of text is to be selected and removed. Develop a program to i) Prompt the user to specify the position (start location and end location). ii) Remove the text from specified position, store it in the Stack "Stack1" (implement using structure) and write the remaining part of "Student.txt" into another file "Student2.txt". iii) Rename "Student2.txt" as "Student.txt" and display the contents of "Student.txt".	stack, File, structure	Able to cut contents of the text file
6	It is required to open the file "Student.txt" and display the contents. Further, a portion of text is to be selected for copying. Develop a program to i) Prompt the user to specify the position (start location and end location). ii) Copy the text from specified position and write the selected text into "Stack2" (implement using linked list).	stack, File, linked list, structure	Able to copy contents of the text file

7	It is required to open the file "Student.txt" and display the contents. Further, a portion of text which was cut or copy is to be pasted at specified location in "Student.txt". Develop a program to i) Prompt the user to specify the start position and paste the text stored in Stack1 (cut) or Stack2 (copy) from start position. ii) Display the contents of "Student.txt".	File, linked list, structure, Stack	Able to paste contents into text file
8	It is required to open the file "Student.txt" and display the contents. Further, when user selects "Undo" operation, the text which was removed most recently is to be pasted **at the same position from where it was removed.** i) Develop a program to Paste the portion of text which was cut or copy most recently at the specified location in "Student.txt".	File ,Structure and stack	Able to undo operations on file
9	It is required to open the file "Student.txt" and display the contents for "Redo" operation. Further, a portion of text is to be selected and removed. Develop a program to i) Prompt the user to specify the position (start location and end location). ii) Remove the text from specified position, store it in the Stack "Stack1" (implement using structure) and write the remaining part of "Student.txt" into another file "Student2.txt". iii) Rename "Student2.txt" as "Student.txt" and display the contents of "Student.txt".	stack, File, structure, stack	Able to redo operations on file
10	It is required to open the file "Student.txt" and display the contents. Develop a program to i) Prompt the user to specify the word/character to search for ii) Display the search results.	File, string	Able to find any string/character in the text file
11	It is required to open the file "Student.txt" and display the contents. Develop a program to i) Prompt the user to specify the word/character to search for ii) Prompt the user to specify the new word/character to replace iii) Replace the searched word with the new word and Display the results.	Arrays ,string	Able to find any word/string/character in the text file and replace with the new word.

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1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in JAVA ", Wiley, 6th Edition, 20l4
2. Herbert Schildt, "The Complete reference Java", 7th edition, 2007

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1. Richard Gilberg, Behrouz Forouzan, “DataStructures: A Pseudocode Approach with C”, Cengage Learning,2004.
2. DebasisSamanta, “Classic DataStructures”, second edition, PHI Learning Private Limited,2011.

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 Department 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-LEARNINGEXERCISES:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives and quantifiers	1 ,2,3	2
CO2	Explain basic concepts and prove basic facts about ordinals and well-ordered sets.	1 ,2,3	2
CO3	Apply the operations like union and intersection on discrete structures such as sets, relations and functions	1 ,2,3	2
CO4	Demonstrate the ability to write and evaluate the proof or outline the basic structure of and give example of each proof technique described.	1 ,2,3	2
CO5	Illustrate the concept of isomorphic graphs and isomorphism invariant properties of graphs	1 ,2,3	2
CO6	Develop a model using advanced concepts of graph for real world applications	1 ,2,3	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											3	
CO2	3	2	3											3	
CO3	3	1	2											3	
CO4	3	2	3											3	
CO5	3	2	2											3	
CO6	3	2	2											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", 5thEdition,, 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	B20CI0302	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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Apply software development process to solve complex problems of engineering.	1,2	2
CO2	Make use of Agile principle for rapid software development	1,3	3
CO3	Summerizethe manifesto and basic principles of agile approach to software development.	1,3,5	1
CO4	Apply the concepts of process modeling and automation in real world applications.	1,3,5	2,3
CO5	Distinguish between the traditional SDLC and agile ALM model for efficient and effective product delivery.	1,3,4	1
CO6	Develop the real world applications using DevOps tools.	1,3,4,5,9	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 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								3		
CO4	3		3		3									3	3
CO5	3		3	3									3		
CO6	3		3	3										3	3

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

COURSE CONTENT

THEORY:

UNIT – 1

Requirements and Development process: Software Processes: Models, Process iteration, Process activities. Software Requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements Engineering Processes: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. Development: Rapid Software Development: Agile methods, Extreme programming and Rapid application development. Software Evolution: Program evolution dynamics, Software maintenance.

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.

TEXTBOOKS:

1. Ian Summerville,"Software Engineering", 8th Edition, Pearson Education,2007.
2. BobAiello and LeslieSachs, "Agile Application Life cycle Management Using DevOps to Drive Process Improvement", Addison Wesly, First printing, 2016.

REFERENCEBOOKS:

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-LEARNINGEXERCISES:

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

Course Title	Communication Skills				Course Type		Theory	
Course Code	B20AH0301	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 is aimed to develop basic communication skills in English in the learners, to prioritize listening andreadingskillsamonglearners,tosimplifywritingskillsneededforacademicaswellasworkplacecontext, to examine that the learners use the electronic media such as internet and supplement the learning materials used in theclassroom.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Develop basic communication skills inEnglish.
2. EmphasizeonthedevelopmentofspeakingskillsamongstlearnersofEngineeringandTechnology
3. Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in theclassroom.
4. Inculcatethehabitofreadingandwritingleadingtoeffectiveandefficientcommunication.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence and comprehension and communicate with oneor many listeners using appropriate communicative strategies (SpeakingSkills).	9,10	
CO2	Build inferences from the text.	10	
CO3	Make use of accurate writing skills using different components of academic writing.	9,10	
CO4	Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a widevocabularyrange,organizingtheirideaslogicallyonatopic	9,10	
CO5	Make use of reading different genres of texts adopting various reading strategies (Reading Skills).	10	
CO6	Apply appropriate vocabulary and grammar in written and spoken context.	9,10	

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	3					
CO2										3					
CO3									1	3					
CO4									2	3					
CO5										2					
CO6									2	2					

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

COURSE CONTENT

THEORY:

UNIT – 1

FunctionalEnglish: Grammar:Prepositions;ModalAuxiliaries, Reading Comprehension, Activeandpassivevoice, Giving Instructions.

UNIT – 2

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

UNIT – 3

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

UNIT – 4

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

TEXTBOOKS:

1. Green,David,“ContemporaryEnglishGrammarStructuresandComposition”,NewDelhi,MacMillan Publishers,2010.
2. Thorpe, Edgar and Showick Thorpe,“Basic Vocabulary”, Pearson Education India, 2012.
3. Leech,GeoffreyandJanSvartvik,“ACommunicativeGrammarofEnglish”,Longman,2003.

REFERENCE BOOKS:

1. Murphy, Raymond. Murphy’s,“English Grammar with CD”,Cambridge University Press, 2004.
2. Rizvi, M. Ashraf, “Effective Technical Communication”, New Delhi, Tata McGraw-Hill, 2005.
3. Riordan, Daniel, “Technical Communication”, New Delhi, Cengage Publications, 2011.
4. Sen et al, “Communication and Language Skills”, Cambridge University Press, 2015.

Course Title	Indian Constitution and Professional Ethics	Course Type	Theory

Course Code	B20LS0301	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 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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.	6,7,8,9,12	
CO2	Demonstrate the practicality of Constitution perspective and make them to face the world as a bonafide citizen.	8 ,12	
CO3	Illustrate the professional ethics and human values.	6,8,12	
CO4	Summarize ethical standards followed by different companies.	7,8,12	
CO5	Demonstrate the Knowledge of Ethics to protect environment as an Engineer	6, 7, 8, 12	
CO6	Apply the principles of Ethics as an employee employer in the professional life	6, 8, 9, 12	

BLOOM'S LEVELOF THECOURSE 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	2	3	2			1			
CO2								3				1			
CO3						2		3				1			
CO4							2	3				1			
CO5						2	2	3				1			
CO6						2		3	1			1			

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

COURSE CONTENT

THEORY:

UNIT – 1

Indian constitution: Salient features, fundamental rights and duties (Directive principle and state policy), 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-LEARNINGEXERCISES:

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

Course Title	Advanced Kannada/Basics of Kannada				Course Type	Theory	
Course Code	B20AHM301/ B20AHM302	Credits	0		Class	III Semester	
Course Structure	TLP	Credits	Contact	Work	Total Number of Classes Per Semester	Assessment in Weightage	
	Theory	0	2	2			
	Practice	-	-	-	Theory	CIE	SEE
	Tutorial	**-**	**-**	**-**			
	Total	**0**	**2**	**2**	**26**	**0**	**0**

ಕನ್ನಡಿಗರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

ಪರಿವಿಡಿ

ಘಟಕ – 1: ಕವಿತೆಗಳು

1. ಬೆಳಗು – ಡ 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'** ಪಠ್ಯಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಕನ್ನಡಿಗರಿಗೆ **'ಸಾಹಿತ್ಯ ಸಿಂಚನ'** ಪಠ್ಯಪುಸ್ತಕ
- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡಿಗರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯಪುಸ್ತಕ

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

ಕನ್ನಡೇತರರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ
ಭಾಷಾ ಕೌಶಲ್ಯಗಳು

ಘಟಕ – 1

1. ಆಲಿ ಸುವುದು
   - 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'** ಪಠ್ಯಪುಸ್ತಕ.
- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡೇತರರಿಗೆ **'ಕನ್ನಡ ಮನಸ್ಸು'** ಪಠ್ಯ ಪುಸ್ತಕ.
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಇವರು **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯಪುಸ್ತಕ ತಂದಿದ್ದಾರೆ.

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

IV SEMESTER

Course Title	Design and Analysis of Algorithm	Course Type	Theory

Course Code	B20EF0401	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:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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.	1to 5,12	1,2,3
CO5	Compare and contrast different algorithm design techniquesand identify the most suitable algorithm design technique for any application.	1 to 5	1,2,3
CO6	Construct any real-world software using existing or creating new algorithm design technique.	1 to 5	1,2,3

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 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	3	3	1								3	3	3
CO6	3	3	3	3	2								3	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, Divide-and-Conquer: Merge sort, Quick sort, Multiplication of Large Integers.Decrease-and-Conquer- Insertion Sort, Depth-First Search and Breadth-First Search, 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

TEXTBOOKS:

1.Anany Levitin," Introduction to the Design and Analysis of Algorithms", Pearson, 3rd Edition, 2012.

2.Ellis Horowitz, SatrajSahni 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	**B20EF0402**	**Credits**	**4**		**Class**	**IV Semester**
	TLP	Credits	Contact Hours	Work Load	Total Number of	

Course Structure					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

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	Pos	PSOs
CO1	Outline the history of Operating System and UNIX environment.	1,2,5,9,10,12	1,3
CO2	Develop the programs to implement the different process states, attributes and control the process in foreground and background.	1,4,5, 9,10,12	1,3
CO3	Compare and analyze the performance of different memory management techniques.	1,4,5, 9,10,12	2,3
CO4	Make use of UNIX file types, file structure and file system implementation.	1,2,4, 5, 9,10,12	1,3
CO5	Summarize the issues of Inter-process Communication.	1,2,4,5, 9,10,12	1,3
CO6	Make use of system calls for managing processes, memory and the file system.	1,4,5, 9,10,12	1,3

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Basic of Operating Systems: Introduction of Operating System,Evolution of Operating Systems, Types of Operating System and operations, Operating System Services,Operating System structure.

Background of UNIX 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, virtual memory, 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/Java program to display the output of any UNIX shell command.	Linux OS	
2.	a) Write a C/Java program to create a sub process by printing its pid and the main process pid value.	Linux OS	Process Control.
	b) Write a C/Java program to show the process is an orphan process and print its parent pid value.		
3.	a) Write a C/Java 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/Java program to avoid zombie process by forking twice.		
4.	a) Write a C/Java program that outputs the contents of its Environment list.	Linux OS	Process Control.
	b) Write a C/Java program to illustrate the race condition.		
5.	a) Write a C/Java 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/Java 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/Java program which demonstrates Interprocess communication between a reader process and a writer process of a FIFO file by using the	Linux OS	Inter Process Communication.
	b) Write a C/Javaprogram 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/Java 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
2	Write a C/Java program to close or delete an account of a created customer accounts of Bank Management	Linux OS	To close an existing account.
3	Write a C/Java program to display all account holders of a created customer accounts of Bank Management	Linux OS	To display all account holders.
4	Write a C/Java program to modify an account of a created customer accounts of Bank Management	Linux OS	To modify account and display the contents.
5	Write a C/Java 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/Java program to deposit and withdraw amount of a created customer account of bank	Linux OS	To withdraw amount and display the contents.
7	Write a C/Java 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/Java 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.

REFERENCEBOOKS:

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

<table>
<tr><td>Course Title</td><td colspan="4">Database Management System</td><td>Course Type</td><td>Integrated</td></tr>
<tr><td>Course Code</td><td>B20EF0403</td><td>Credits</td><td colspan="2">4</td><td>Class</td><td>IV Semester</td></tr>
<tr><td rowspan="2"></td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td rowspan="2">Total Number of Classes Per Semester</td><td rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
</table>

Course Structure	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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 9,10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,9,10,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5, 9,10,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1to 5, 9,10,12	1,2
CO5	Construct the physical and logical database designs, database modeling, relational, hierarchical, and network models.	1to 5, 9,10,12	1,3
CO6	Relate conceptual model to relational model and formulaterelational algebra queries.	1to 5, 9,10,12	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#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				3	3		1	3	3	
CO2	3	3	2	3	1				3	3		1	3	3	
CO3	3	3	2	3	3				3	3		1	3	3	3
CO4	3	3	2	3	1				3	3		1	3	3	
CO5	3	2	3	3	3				3	3		1	3		3
CO6	3	3	2	3	3				3	3		1		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:

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. 8. Find the eids of employees who are certified for the largest number of aircraft. 9. Find the eids of employees who are certified for exactly three aircraft. 10. Find the total amount paid to employees as salaries	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

REFERENCEBOOKS:

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-LEARNINGEXERCISES:

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

Course Title	Computer Organization and Architecture				Course Type		Integrated	
Course Code	B20EF0404	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:

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

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of ARM processor instruction set for developing simple assembly programs.	1,2,5,9,10,12	1
CO2	Interpret the functional architecture of computing systems.	1,2,5, 9,10,12	1
CO3	Identify the issue related to instruction set architecture,memory unit and control unit and I/O functions.	1,2,5, 9,10,12	1
CO4	Develop a real world application using parallel processing concepts.	1,2,4, 9,10,12	1,2,3
CO5	Summarize the common components and organization of memory unit and I/O functions.	1,2,4, 9,10,12	1
CO6	Experiment with the multitasking of different programs.	1,2,4,9,10,12	1,2,3

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 ARTICULATION MATRIX

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

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, Registerstructure, 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.

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Write a program to display the text "REVA UNIVERSITY" on a LCD Display.	MC board	Learn about sensors
2	Develop a program to demonstrate the up/down counter from 00 to 99.	MC board	Learn about sensors
3	Design a program to interface and control the stepper motor to rotate in the specified direction.	MC board	Learn about sensors
4	Write a program to interface 4X4 keypad with the microcontroller.	MC board	Learn about
5	Control the on/off status of LED using switches.	MC board	Learn about
6	Determine the rise in temperature using Temperature sensor.	MC board	Learn about
7	Determine the leakage of gas.	MC board	Learn about

Part-B Mini-project

S. No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Create a lift operation sequence using LED interface. The lift should move from floor 0 to floor 10. During movement of the lift, requests from intermediate floors should be considered. The LED should display the current floor number of the lift based on its movement.	Arm Tool kit, Keil software,	Assembly Language programming
2	Create a phone booth monitor. The LCD device should display the time used and the cost involved in the call. The keypad	Arm Tool kit, Keil software,	Assembly Language programming

	should tell the number that you want to dial.		
3	Create an attendance system using keypad, LCD / 7 segment display screen. The user should type in the employee id and get his attendance marked for the morning session and later one more punch with employee id for closing the attendance.	Arm Tool kit, Keil software,	Assembly Language programming
4	Implement an automatic door opening system using keypad, LCD device.	Arm Tool kit, Keil software,	Assembly Language programming
5	Create a traffic light simulation environment.	Arm Tool kit, Keil software,	Assembly Language programming

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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	1 to 5,12	3

CO4	Develop mathematical equations with simplex method and Transportation-Assignment problem for linear programming	1 to 5,12	1,2,3
CO5	Apply various mathematical equations with simplex method for linear programming	1 to 5,12	1,2,3
CO6	Develop mathematical equations for Transportation-Assignment problem.	1 to 5,12	1,2,3

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 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	3	3	3	3	3							1	3	3	3
CO6	3	3	3	3	3							1	3	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 duality-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 BOOKS:

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	Management Science				Course Type		Theory	
Course Code	B20MGM301	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:

The course intends to familiarize 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 emphasizes on giving an overview of the functional area of management

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.To help the students gain understanding of the functions and responsibilities of managers.

2. To provide them tools and techniques to be used in the performance of the managerial job.

3. To enable them to analyze and understand the environment of the organization.

4. To help the students to develop cognizance of the importance of management principles.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Plan organizational structure for a given context in the organisation carry out production operations through Work-study.	1-5	1,2
CO2	Analyse production operations through Work-study.	1-5	1,2
CO3	Understand the markets, customers and competition better and price the given products Appropriately.	1-5	1,2
CO4	Summarize the HR function better.	1-5	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			√			

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								2	2	
CO2	1	1	3	3	3								2	2	
CO3	1	3	2	3	1								2	2	
CO4	1	1	3	2	5								2	2	

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 OrganisationDepart 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.

TEXTBOOKS:

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.

REFERENCEBOOKS:

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	B20AS0303	Credits	2		Class	IV Semester	
Course Structure			Contact	Work	Total Number of Classes Per Semester	Assessment in Weightage	
	Theory	2	2	2			
	Practice	-	-	-	Theory	CIE	SEE
	Tutorial	**-**	**-**	**-**			
	Total	**2**	**2**	**2**	**26**	**50**	**50**

COURSE OVERVIEW:

This introductory course is designed to introduce you to the foundational concepts of environmental engineering, types of resources, biodiversity, threats and methods of conservation, sources and control measures of environmental pollution and ways to protect the environment.

COURSE OBJECTIVE(S):

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.	2,7,8,12	
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products	2, 7,8,12	
CO3	Classify different wastes, sources of waste and their effect on population	2,7,8,12	
CO4	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	2,7,8,9,10,12	
CO5	Critically analyse the ecological imbalances and provide recommendations to protect the environment.	2,7,8,9,10,12	

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		√				

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENTS
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 - Importance, 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.

REFERENCE BOOKS:

1. Dr.S.M.Prakash, “Environmental Studies”, Elite Publishers, Mangalore, 2nd Edition, 2009.
2. Rajagopalan R, “Environmental Studies – from Crisis to cure”, Oxford University Press, New Delhi, 3rd Edition, 2016

3. Anil Kumar Dey and Arnab Kumar Dey, “Environmental Studies”, New age international private limited publishers, New Delhi, 2nd Edition, 2007.
4. Michael Allaby, “Basics of environmental Science”, Routledge-Tayler &Francis e-library, New York, 2nd Edition, 2002.
5. Dr.Y.K Singh, “Environmental Science”, New age international private limited publishers, New Delhi, 1st Edition, 2006

JOURNALS/MAGAZINES:

1. International Journal of Environmental Science and Technology, https://www.springer.com/journal/13762/
2. Journal of Environmental Sciences, https://www.journals.elsevier.com/journal-of-environmental-sciences

SWAYAM/NPTEL/MOOCs:

1. Environmental Studies: https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2. Environmental Studies: https://nptel.ac.in/courses/120/108/120108004/

SELF-LEARNING EXERCISES:

1. Discussion on the need for public awareness on the environment, Gaia Hypothesis
2. Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes, Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.
3. Hydrology & modern methods adopted for mining activities, Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.
4. Discussion on the need for balanced ecosystem and restoration of degraded ecosystems.

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	0	2	2				
	Practice	0	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**0**	**2**	**2**	**26**	**0**	**0**	**0**

COURSE OVERVIEW:

Basic human values refer to those values which are at the core of being human. The values which are considered basic inherent values in humans include truth, honesty, loyalty, love, peace, etc. because they bring out the fundamental goodness of human beings and society at large. This subject focuses on developing holistic perspective and harmony on self-exploration among individuals,family and society.

COURSE OBJECTIVE(S):

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

COURSEOUTCOMES(COs):

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	3,6,7,8, 9,10	
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	3,6,7,8, 9,10	
CO3	Understand the role of a human being in ensuring harmony in society and nature.	3,6,7,8	
CO4	Demonstrate the role of human being in the abetment of pollution.	3,6,7,9	
CO5	Describe appropriate technologies for the safety and security of the society as responsible human being.	9,10,11, 12	
CO6	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	9,10,11, 12	

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			1			3	3	3	3	3					
CO2			1			3	3	3	3	3					
CO3			1			3	3	3							
CO4			1			3	3		3						
CO5									3	3	3	2			
CO6									2	3	3	2			

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

TEXT BOOKS

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", NavajivanMudranalaya, Ahmadabad, 1993
4. William Lilly, "Introduction to Ethics", Allied Publisher, London, 1955

JOURNALS/MAGAZINES/ONLINE COURSES

1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Production

SELF-LEARNING EXERCISES:

1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of i) What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect? ii) What is Naturally Acceptable to you – to nurture or to exploit others? Is our living the same as your natural acceptance or different?
2. Out of the three basic requirements for fulfilment of your aspirations- right understanding,relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.
3. Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

3rd Year Syllabus

V SEMESTER

Course Title	Web Technologies			Course Type	HC
Course Code	B20EF0501	Credits	3	Class	V Semester

	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
Course Structure	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**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, Perl and PHP.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic concepts of HTML code.
2. Illustrate the use of Cascading Style Sheets in web pages.
3. Demonstrate the use of Angular JS, Java Scripts and XML in real world applications.
4. Describe the principles of object oriented development using Perl and PHP.

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Experiment with various HTML tags to create a web page for real world applications.	1 to 5 , 9,10,12	1
CO2	Apply Cascading Style Sheets to design a web page for real world applications.	1 to 5 , 9,10,12	1
CO3	Develop client-side environment using AngularJS, JavaScripts and XML for Web based applications.	1 to 5, 9,10,12	2,3
CO4	Build a server-side environment using PHP for Web based application	1 to 5, 9,10,12	2,3
CO5	Develop real time web applications.	1 to 5, 9,10,12	1,3
CO6	Make use of java and server side scripting languages to develop web applications.	1 to 5, 9,10,12	2,3

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	3	1	3	3	2				3	3		3	3		
CO2	3	2	2	3	2				3	3		3	3		
CO3	3	2	3	3	2				3	3		3		3	3
CO4	3	2	3	3	2				3	3		3		3	3
CO5	3	3	2	2	3				3	3		3	3		3
CO6	3	2	3	3	2				3	3		3		3	3

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

COURSE CONTENT

THEORY:

UNIT–1

Introduction to HTML: HTML Syntax, Semantic Markup, Structure of HTML Documents, HTML Elements, HTML Semantic Structure Elements, HTML Web Storage. HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements,Table and Form Accessibility, Microformats.

UNIT–2

Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, CSS Text Styling.

Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing MulticolumnLayouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

UNIT–3

JavaScript: Client-Side Scripting, JavaScript's History and Uses, JavaScript Design Principles, Where Does JavaScript Go? Syntax, Control statements, Functions, JavaScript Objects, Constructors, The Document Object Model (DOM), JavaScript Events, Forms.

UNIT–4

Introductionto server-side Development with PHP: Arrays and Superglobals, Arrays, $GET and $POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.

TEXTBOOKS:

Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st Edition, 2016

Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 1st Edition, 2006.

Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2007.

REFERENCEBOOKS:

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", O'Reilly Publications, 4th Edition, 2015.
2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, 5th Edition 2016.
3. Nicholas C Zakas, "Professional JavaScript for Web Developers", Wrox/Wiley India, 3rd Edition 2012.
4. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 1st Edition, 2014
5. Zak Ruvalcaba Anne Boehm, "Murach's HTML5 and CSS3", Murachs/Shroff Publishers & Distributors Pvt Ltd, 3rd Edition, 2016.
6. Gerardus Blokdyk, "Representational State Transfer: Practical Integration", CreateSpace Independent Publishing Platform, 1st Edition, 2018
7. Michael Fitzgerald, 'Learning Ruby", O'Reilly, 1st Edition, 2007

JOURNALS/MAGAZINES:

1. https://www.inderscience.com/jhome.php?jcode=ijwet
2. http://stmjournals.com/Journal-of-Web-Engineering-and-Technology.html
3. https://www.scimagojr.com/journalsearch.php?q=15657&tip=sid
4. https://www.smashingmagazine.com/
5. https://www.computer.org/publications/computing-edge

SWAYAM/NPTEL/MOOCs:

1. Coursera - Web Design: Wireframes 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:

1. HTML5
2. JQuery
3. XML
4. Ruby
5. Introduction to REST and RESTful API

Course Title	Computer Networks				Course Type		HC	
Course Code	B20EF0502	Credits	3		Class		V 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 main emphasis of this course is on the organization and management of local area networks (LANs). The course description includes 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 6,9,10, 12	2
CO2	Discover the good network design with simplicity, scalability, performance and the end-to-end principle	1 to 6,9,10, 12	2
CO3	Appraise the working principles of Internet.	1 to 6,9,10, 12	3
CO4	Compile the effectiveness of existing or similar network protocols.	1 to 6,9,10, 12	2,3
CO5	Summerizethe key components of the Network.	1 to 6,9,10, 12	2, 3
CO6	Demonstrate different protocols used in real world application.	1 to 6,9,10, 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	3	3	2	1			3	3		1		3	
CO2	3	3	3	3	2	2			3	3		1		3	
CO3	3	3	3	3	2	1			3	3		2			3
CO4	3	3	3	2	2	1			3	3		1		3	3
CO5	3	3	3	3	2	2			3	3		2		3	3
CO6	3	3	3	3	2	2			3	3		2		3	3

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

COURSE CONTENT

THEORY:

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.

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.

TEXTBOOKS:

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

REFERENCEBOOKS:

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.

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-LEARNINGEXERCISES:

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

Course Title	Machine Learning				Course Type		HC	
Course Code	B20EF0503	Credits	3		Class		V 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 introduces the fundamental concepts of machine learning, data exploration, information-based learning, similarity-based learning, probability based learning, and error based learning. It also discusses the concepts of Artificial Neural networks and perform analysis on machine learning experiments.

COURSE OBJECTIVE (S):

The main objectives of this course are:

1. Understand different learning algorithms and the techniques of data exploration.
2. Illustrate supervised machine learning techniques that are suitable for applications.
3. Describe probability based machine learning algorithms and error optimization.
4. Discuss the concepts of ANN and perform evaluation on the trained models.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the fundamental concepts of machine learning and data exploration.	1,2,3,5,11,12	1,2,3
CO2	Implement the concepts of supervised machine learning algorithms to predict the output class labels.	1,2,3,4,5,9,11,12	1,2,3
CO3	Demonstrate probability based learning techniques to predict the solutions for real world problems.	1,2,3,4,5,6,9,11, 12	1,2,3
CO4	Apply error minimization techniques to optimize the machine learning model.	1,2,3,5,12	1,2,3
CO5	Compare biological neuron vs artificial neuron and develop applications using neural networks.	1,2,3,4,5,9,11,12	1,2,3
CO6	Analyze and evaluate the performance of machine learning experiments.	1,2,3,4,5,6,9,11, 12	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	3	2		3						3	3	1	2	2
CO2	3	2	3	3	3				3		3	3	2	3	2
CO3	3	2	3	3	3	2			3		3	3	1	2	3
CO4	3	3	3		3							3	3	2	3
CO5	3	2	3	3	3				3		3	3	3	3	3
CO6	3	2	3	3	3	2			3		3	3	3	3	3

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

COURSE CONTENT

UNIT – 1

Machine Learning: What is Machine Learning? How does Machine Learning Work? What can go wrong with Machine Learning? What is Predictive Data Analytics? The Predictive Data Analytics Project Life Cycle: CRISP-DM and Predictive Data Analytics Tools, Designing & Implementing Features: Different types of data, different types of features.

Data Exploration- Getting to know the Data, Preprocessing: Identifying Data Quality Issues, Handling Data Quality Issues, Advanced Data Exploration, Data Preparation, Feature selection, Forward Sequential Selection, Backward Sequential Selection.

UNIT – 2

Information-based Learning: Decision Trees, Shannon's Entropy Model, Information Gain, Standard Approach: The ID3 Algorithm, A Worked Example: Predicting Vegetation Distributions, Alternative Feature Selection & Impurity Metrics, Handling Continuous Descriptive Features, Predicting Continuous Targets, Tree Pruning and Model Ensembles, Case studies.

Similarity-based Learning: Feature Space, Measuring Similarity Using Distance Metrics, Standard Approach: The Nearest Neighbor Algorithm, Handling Noisy Data, Efficient Memory Search Data Normalization, Predicting Continuous Targets, Other Measures of Similarity, Case studies.

UNIT – 3

Probability-based Learning: Baye's Theorem, Bayesian Prediction, Conditional Independence &Factorization, Standard Approach: The Naive Bayes Model, A Worked Example.

Error-based Learning: Simple Linear Regression, Measuring Error, Error Surfaces, Standard Approach: Multivariable Linear Regression with Gradient Descent, Multivariable Linear Regression, Gradient Descent, Choosing Learning Rates & Initial Weights, A Worked Example.

Unit 4

Artificial Neural Networks: Introduction, Neural Network Representation, Appropriate problems for Neural Network Learning, Perceptrons, Multilayer Networks and Back Propagation Algorithm.

Analysis of Machine Learning Experiments: Introduction, Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Methods, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing.

TEXT BOOKS:

1. John D Kelleher, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics- Algorithms, Worked Examples and case studies", MIT Press, 2015.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.
3. Ethem Alpaydin, - Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

REFERENCE BOOKS:

1. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1stedition, 2001.
2. Stephen Marsland, - Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

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
4. https://www.edx.org/learn/machine-learning

SELF-LEARNING EXERCISES:

1. Data Visualization
2. Bar Plots
3. Histograms
4. Box Plots

Course Title	System Programming				Course Type		Theory-SC	
Course Code	B20EFS511	Credits	3		Class		V 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 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)

On successful completion of this 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 to 5,12	1
CO2	Identify the suitable data structures required to develop various system softwares.	1 to 5,12	1
CO3	Develop the programs for the pass1 and pass2 algorithms of linkers and loaders.	1 to 5	1,2
CO4	Apply functions and algorithms of macro-processor to process a given macro definition.	1 to 5,9,10,11	1,2
CO5	Classify different components of system softwares.	1 to 5	2,3
CO6	Identify the steps for intermediate code generation in context of language designing.	1 to 5	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	2							1	3		
CO2	2	2	2	2	1							1	3		
CO3	2	2	1	1	1								3	3	
CO4	2	1	1	1	1				2	2	2		3	3	
CO5	2	3	3	3	3									3	3
CO6	3	3	3	2	3									3	3

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

COURSE CONTENT

THEORY:

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

TEXTBOOKS:

1.Leland L Beck, "System Software", 3rd Edition, Pearson Education, 2002.

2.Alfred V. Aho, "Compilers: Principles, Techniques and Tools", Pearson, 2nd Edition, 2013.

REFERENCEBOOKS:

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

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:

1. Design of a micro preprocessor,
2. Peep hole optimizer and
3. Compile and GO loader.

Course Title	Object Oriented Programming with C++				Course Type		Theory-SC	
Course Code	B20EFS512	Credits	3		Class		V 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:

This course introduces the basic concepts of object oriented programming. Familiarizes with object creation and accessing members of object. OOP concepts such as data abstraction, information hiding(Encapsulation),overloadingoperations,inheritancemechanisms,virtual functions and friend functions are discussed. File I/O operations, Templates and exception handling mechanisms are also introduced.

COURSE OBJECTIVE (S):

1. Explainthebasicconceptsofobjectsandclassesforarealworldapplication.
2. Illustratetheuseofoperatoroverloading/functionoverloadingforgiven applications.
3. Demonstrate the use of inheritance in real world applications.
4. Describe I/O streams and Templates and Exception Handling.

COURSEOUTCOMES(COs)

On successful completion of this 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.	1 to 5, 9 , 10	1
CO2	Utilize operator overloading / function overloading in given real world applications.	1 to 5,9,10	2
CO3	Develop programs using Inheritance feature of objectoriented programming.	1 to 5, 9, 10,11	1,2
CO4	Solve programs using I/O streams,Templates and Exception Handling.	1 to 5,9,10,11	1,3
CO5	Classify inheritance based on early and late binding, exception handlingand generic programming in real world application.	1 to 5, 9, 10	2,3
CO6	Explain the concept of data security using access specifiers in building real world application.	1 to 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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

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 over loading: 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++",4thEdition,TataMcGrawHill,2003.

2.SanleyB.Lippmann,JoseeLajore,"C++Primer",4th Edition, Pearson Education,2005.

REFERENCE BOOKS:

1. PaulJDeitel, HarveyMDeitel, "C++ for Programmers", Pearson Education,2009.

2.KRVenugopal, Rajkumar Buyya,TRaviShankar,"Mastering C++",TataMcGrawHill, 1999.

3. ACM, ACM Transactionson Programming Languages and Systems(TOPLAS).

4.ACM Journal on Object-Oriented Programming

JOURNALS/MAGAZINES:

1. https://www.geeksforgeeks.org/introduction-of-object-oriented-programming/
2. https://www.geeksforgeeks.org/best-practices-of-object-oriented-programming-oop/
3. https://www.britannica.com/technology/object-oriented-programming
4. https://www.codeproject.com/Articles/22769/Introduction-to-Object-Oriented-Programming-Concept

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:

1. I/O System Basics,
2. File I/O: C++ stream classes,
3. Formatted I/O,
4. <fstream> and File classes.

Course Title	Advanced IOT and Applications				Course Type		Theory-SC	
Course Code	B20EFS513	Credits	3		Class		V 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:

In general, IoT is a network of devices every object is connected through internet or some non-internet oriented connections like Bluetooth, ZigBee, etc. It features an IP address for Internet connectivity, and the communication occurs between these objects and other Internet-enabled devices and systems. The course covers the IoT Impact, Convergence of IT and IoT, and IoT Challenges. It also explains an Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics. The usage of various microcontroller boards such as Arduino, Raspberry and Adafruit are covered.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Examine the genesis and impact of IoT applications, architectures in real world.
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT.
4. Discuss sensor technologies used for sensing real world entities.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.	1 to 5	1,3
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.	1 to 5	1,3
CO3	Identify the need for Data Analytics and Security in IoT.		1,3
CO4	Outline the role of IoT protocols for efficient network communication.		1,3
CO5	Identify different concepts of advanced of IoT in real time applications.	1 to 5	2,3
CO6	Analyze the data received through sensors in IOT.	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

UNIT – 1

Network Architectures: Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. Smart Objects, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT – 2

Layers in IoT Systems: IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT – 3

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in OT Security, How IT and IOT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT – 4

Hardware in IoT Systems: IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, 10 Hours Smart City Security Architecture, Smart City Use-Case Examples.

TEXT BOOKS:

1. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017.
2. Srinivasa K G, “Internet of Things”, CENGAGE Leaning India, 2017.

REFERENCE BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Pearson Education (Cisco Press Indian Reprint).
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.

JOURNALS/MAGAZINES:

1. IEEE Wireless Communications
2. IEEE Sensors Journal
3. IEEE Communications Surveys and Tutorials

4. IEEE Intelligent Systems
5. IEEE Transactions on Wireless Communications
6. Proceedings of the IEEE
7. IEEE Transactions on Computers
8. ICT Express

SWAYAM/NPTEL/MOOCs:

1. Introduction to internet of things, Indian Institute of Technology, Kharagpur and NPTEL via Swayam
2. Introduction and Programming with IoT Boards (Coursera)
3. Software Architecture for the Internet of Things (Coursera)
4. Cybersecurity and the Internet of Things (Coursera)
5. MicroMasters® Program in Internet of Things (IoT)

SELF-LEARNINGEXERCISES:

Installation and working on the IDEs required for executing projects using Arduino and Raspberry.

Course Title	Object Oriented Analysis and Design				Course Type		Theory-SC	
Course Code	B20EFS514	Credits	3		Class		V 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:

This course introduces object models and designs from system requirements; use the modelling concepts provided by UML; identify use cases and expand them into full behavioral designs; expand the analysis into a design ready for implementation and construct designs that are reliable. The course begins with an overview of the object-oriented analysis and design.

COURSE OBJECTIVE (S):

The objective of this course is to:

1.Explain the object-oriented models for developing large applications

2.Describe the classes and objects.

3.Demonstrate the use of various UML diagrams in real world applications.

4.Discuss different case studies that make use of OOAD concepts.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	Pos	PSOs
CO1	Identify suitable object models for solving the given real world problems.	1 to 5, 9 , 10	1
CO2	Apply static and dynamic models for solving the given real world problems.	1 to 5,9,10	3
CO3	Analyse and Design UML diagrams for the given real world application.	1 to 5, 9, 10,11	1,2
CO4	Design real world application using Object oriented approach.	1 to 5,9,10,11	2,3

CO5	Identify and model structural and behavioural concepts of the system.	1 to 5,9,10,11	2,3
CO6	Apply the concepts of architectural design for deploying the code for software.	1 to 5,9,10,11	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 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	2			3		
CO2	2	2	2	2	1				1	2					3
CO3	2	2	1	1	1				2	3	2		3	3	
CO4	2	1	1	1	1				3	3	2			3	3
CO5	3	2	3	3	3				3	3	3			3	3
CO6	3	3	3	3	3				3	3	3			3	3

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

COURSE CONTENT

THEORY:

UNIT- 1

Complexity: The Structure of Complex Systems, Inherent Complexity of Software, five Attributes of a Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos On Designing Complex Systems.

The Object Model: The Evolution of the Object Model, Foundations of the Object Model, Elements of the Object Model, Applying the Object Model.

UNIT- 2

Classes and Objects: The Nature of an Object, Relationships among Objects, The Nature of a Class, Relationships among Classes, The Interplay of Classes and Objects, On Building Quality Classes and Objects.

Classification: The Importance of Proper Classification, Identifying Classes and Objects, Key Abstractions and Mechanisms.

UNIT- 3

Notation: The Unified Modelling Language, Package Diagrams, Component Diagrams, Deployment Diagrams, Use Case Diagrams, Activity Diagrams, Class Diagrams, Sequence

Diagrams, Interaction Overview Diagrams, Composite Structure Diagrams, State Machine Diagrams, Timing Diagrams, Object Diagrams, Communication Diagrams. Process: First Principles, The Macro Process: The Software Development Lifecycle, The Micro Process: The Analysis and Design Process.

UNIT- 4

Case Study: Web Application: Vacation Tracking System: Inception, Elaboration, Construction, Transition and Post-Transition.

TEXT BOOKS:

1.Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen and Kelli A. Houston, "Object-Oriented Analysis and Design with Applications", Third Edition, Addison Wesley, 2009.

REFERENCE BOOKS:

1. Brett McLaughlin, Gary Pollice, David West, "Head First Object-Oriented Analysis and Design:ABrainFriendlyGuidetoOOA&D",OreillyMediaInc,2007.

2.Brahma Dathan, Sarnath Ramnath, "Object-Oriented Analysis, Design and Implementation: An Integrated Approach", Springer Universities Press,2015.

3.James J. Odell, "Advanced Object-Oriented Analysis and Design Using UML", SIGS Books and Mutimedia,1998.

JOURNALS/ MAGAZINES:

1. Elsevier Journal of systems andsoftware.
2. Springer Journal of Object-OrientedProgramming.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/courses/106/105/106105153/
3. https://onlinecourses.nptel.ac.in/noc20_cs59/preview

SELF-LEARNING EXERCISES:

1. https://objectdiscovery.com/training/course/analysis/uml/outline.html
2. https://www.classcentral.com/course/object-oriented-design-9216

Course Title	Artificial Intelligence and Applications				Course Type		Theory-SC	
Course Code	B20EFS515	Credits	3		Class		V 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:

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 /algorithms for, problem solving and controlling the knowledge and also demonstrates various learning methods for constructing knowledge and taking decisions.

COURSE OBJECTIVE (S):

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.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Utilize the AI search strategies and production system.	1 to 5	1
CO2	Apply the logic and apply reasoning methods for given real world problem.	1 to 5	3
CO3	Make use of planning and probability to solve uncertainty problems.	1 to 5	3
CO4	Develop an intelligent agent in a specific environmentto solve real world problems.	1 to 5	2,3
CO5	Classify the techniques which involves perception, reasoning and learning in real world applications.	1 to 5	2,3
CO6	Analyze real world problems to understand the dynamic behavior of a system.	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

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.

TEXTBOOKS:

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.

REFERENCEBOOKS:

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.
4. ACM, ACM transaction on Multi-Agent System.
5. IEEE, IEEE transaction for computational Intelligence.
6. Springer, Springer transaction for security based intelligent systems.

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.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	**Business Intelligence**				**Course Type**		**Theory-SC**	
Course Code	**B20EFS516**	**Credits**	**3**		**Class**		**V 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:

This course provides a useful insight to introduction to the concepts of business intelligence (BI) being as modules and functionality of data systems. It delves into how business challenges can be solved effectively by using operational data to establish data warehouses, and then utilizing data mining tools and analytics to achieve new perceptions into structural procedures. Exhaustive discussion of the analysis, design, and implementation of systems for BI, including the differences between types of reporting and analytics, enterprise data warehousing, data management systems, decision support systems, knowledge management systems, big data, and data/text mining. Case studies are used to study the use of application software, web tools, success, and limitations of BI as well as technical and social issues.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the turbulent business environment and describe how organizations survive.
2. Comprehend the need for computerized support of managerial decision making.
3. Describe the business intelligence methodology and concepts.
4. Discuss the various types of analytics.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Outline modern concepts, theories, and research in the field of Business Intelligence (BI).	1 to 4, 8, 9 , 12	1,2,3
CO2	Identify the different visualization techniques used to represent the real time data.	1 to 3, 5,9,12	1
CO3	Apply modern BI practices, including knowledge integration, sourcing, and managing BI solutions real time problems.	1 to 5, 9, 12	1,2,3

CO4	Make use of BI enabling technologies in organizational settings.	1,4,5,9,12	1
CO5	Categorize and assess consumer behavior and its influence on business decisions.	1 to 5	1,3
CO6	Apply big data technologies in business intelligence .	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

An overview of Business Intelligence, Analytics, and Decision Support: Changing Business environments and computerized Decision support, A framework for BI, Intelligence creation, Use, and BI Governance, Successful BI implementation, Analytics overview, Brief Introduction to Big Data Analytics.

Data Warehousing: Data Warehousing definitions and concepts, Data Warehousing process overview, Data Warehousing architectures, Data Warehousing development, Data integration and the extraction, transformation, and load process.

UNIT – 2

Business Reporting, Visual Analytics, and Business performance Management: Business Reporting definitions and concepts, Data and Information Visualization, Different types of Charts and Graphs, Performance Dashboards, Business Performance Management, Performance measurement, Balanced scoreboards, Six sigma as a Performance measurement system.

UNIT – 3

Text and Web Analytics: Text analytics and text mining overview,Natural language processing, Text Mining applications, Text mining process, Sentiment analysis, Search engines, Web Usage mining, Social Analytics.

Big Data Analytics: Big Data definition and technologies, Big data and data warehousing, Big data and stream analytics, Applications of stream analytics.

UNIT – 4

Business Analytics: Emerging Trends and Future Impacts: Location- based analytics for organizations, Analytics applications for consumers, The web 2.0 revolution and online social networking, Cloud computing and BI, **Impacts of analytics in organizations:** an overview, Issues of legality, privacy and ethics, An overview of the analytical ecosystem.

TEXTBOOKS:

1. Ramesh Sharda, DursunDelen, Efraim Turban, "Business Intelligence: A Managerial Perspective on Analytics", Pearson Publications, 2018
2. Ramesh Sharda, DursunDelen, Efraim Turban," Decision Support and Business Intelligence Systems", Pearson Publications, 2016

REFERENCEBOOKS:

1. GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley Publications, 2016
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2015
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.
5. Ralph Kimball ,Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.
6. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.

JOURNALS/MAGAZINES:

1. http://www.businessintelligence-book.com
2. https://ebooks.lpude.in/computer_application/mca/term_6/DCAP606_BUSINESS_INTELLIGENCE.pdf
3. https://www.researchgate.net/publication/226752489_Business_Intelligence/link/54ada0d70cf2828b29fcb06f/download

4. http://www.redbooks.ibm.com/pubs/pdfs/redbooks/sg245747.pdf
5. https://ppcexpo.com/Content/lecture02.pdf
6. http://www.biomedicahelp.altervista.org/Magistrale/Clinics/BIC_PrimoAnno/IdentificazioneModelliData Mining/Business%20Intelligence%20-%20Carlo%20Vercellis.pdf

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_mg24/preview
2. https://www.mooc-list.com/tags/business-analytics
3. https://www.my-mooc.com/en/categorie/business-intelligence
4. https://www.coursera.org/learn/business-intelligence-tools

SELF-LEARNINGEXERCISES:

1. Explore Decision Support for BI
2. More exploration on Data Mining and Optimization using BI
3. Data Visualization packages

Professional Electives-2

Course Title	Compiler Design				Course Type		Theory-SC	
Course Code	B20EFS517	Credits	3		Class		VSemester	
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:

This course studies the principles of programming languages with an emphasis on programming language implementation and compiler design. This includes various techniques for describing and defining a language, as well as techniques for implementing compilers. Compilers and translators; lexical and syntactic analysis, top-down and bottom up parsing techniques, internal form of source programs; semantic analysis, symbol tables, error detection and recovery, code generation and optimization. Type checking and static analysis. Algorithms and implementation techniques for type-checking, code-generation and optimization.

COURSE OBJECTIVE (S):

The objectives of this course are to:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the lexical, syntactic and semantic analysis into meaningful phases for a compiler to translate statements of source language.	1 to 5	1
CO2	Experiment the knowledge of different parsers by constructing the top dow and SLR parsers.	1 to 5	2

CO3	Make use of different types of parsers and syntax directed definition and translation to check the syntax of the given input.	1 to 5	1,3
CO4	Develop the code optimization and code generation for a given source code.	1 to 5	2,3
CO5	Identify the major phases of compilation to understand the working of system software.	1 to 5	1,2
CO6	Demonstrate different parsers and their implementation using stack.	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT- 1

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;

TEXTBOOKS:

1. 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.
2. Compilers: Principles, “Techniques and Tools by A. V. Aho, R. Sethi, J. D. Ullman. Addison-Wesley, 1986.
2. Modern compiler implementation in ML by A. W. Appel. Cambridge University Press, 1997

JOURNALS/MAGAZINES:

1. IEEE, IEEE Transactions on Computers.
2. Elsevier, Computer Languages, Systems and Structures.
3. Springer, Journal of Logic, Language and Information.
4. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).

SWAYAM/NPTEL/MOOCs:

1. https://www.classcentral.com/course/swayam-compiler-design-12926
2. https://www.edx.org/course/compilers
3. https://www.coursera.org/courses?query=compilers

SELF-LEARNINGEXERCISES:

1. https://online.stanford.edu/courses/soe-ycscs1-compilers
2. https://www.udemy.com/course/introduction-to-compiler-construction-and-design/
3. https://www.udacity.com/course/compilers-theory-and-practice--ud168

Course Title	Network Programming				Course Type		Theory-SC	
Course Code	B20EFS518	Credits	3		Class		V 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**	**00**	**50**	**50**

COURSE OVERVIEW:

This course is focusing on the programming aspects of computer networks. The goal of this course is to understand the current trends of communication protocols, socket programming, interprocess communication, and to understand how network research is done. Further, this course introduces the basics of computer networks, network Security and Internet programming. Students acquire knowledge of client-server architecture and secure network communication.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the basics of the TCP/IP protocol suite and some of its widely used protocols.
2. Develop an application using client and server Architecture for a real-world application.
3. Understand the basics of network security.
4. Analyze Case Study of Networked Application and Secure Networked Application

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the use of socket programming in a real-world application	1 to 5,10	1
CO2	Develop an application using client and server Architecture for a real-world application.	1 to 5,10	2
CO3	Demonstrate the various methods of securing a network application.	1 to 5,10	1,2
CO4	Analyze Case Study of Networked Application and Secure Networked Application	1 to 5,10,11	2,3

CO5	Develop applications using techniques such as multiplexing, forking, multithreading in network communication.	1 to 5,10	1,3
CO6	Identify different encryption and decryption techniques to maintain security in real world network communication.	1 to 5,10	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Networks and Protocols: Circuits vs. Packets, Internetworking, Ethernets, Ethernet Frames, Addressing, Internet Protocol, User Datagram Protocol, Transmission Control Protocol, The Client- Server Model, The Domain Name System, State vs. Stateless, Methods for Maintaining State; Socket Programming: What Is a Socket, Using Sockets, User Datagram Protocol, File Transfer, and Error Handling.

UNIT – 2

Client-Server Architecture: Client Test Program, Multiplexing, Forking, Multithreading, Combining Preforming and Pre-threading, Method Choosing, Dealing with Large Amounts of Data, Debugging and Development Cycle;

Custom Protocol Implementation: Designing a Custom Protocol, Our Chat Protocol, Protocol Registration, TCP vs. UDP, Application Protocol Choices, Client-Server Architecture, Client-Side Considerations, Server-Side Consideration

UNIT – 3

Securing Network Communication: Tunnelling, Public Key Infrastructure, Secure Network Programming Using OpenSSL, The Old Scenario, The Present-Day Scenario, The PAM Library, Public Key Authentication, Single Sign-on, Common Attacks, Buffer Overflow, Secure Coding, Tools of the Trade

UNIT – 4

Case Study1: A Networked Application: The Server, The Client

Case Study2: A Secure Networked Application: The Necessary Decisions, Code Design and Layout, The Code, Analysis.

TEXTBOOKS:

1. Keir Davis, John Turner and Nathan Yocom, "The Definitive Guide to Linux Network Programming'', Apress, First edition, 2004.

2. Warren Gay, "Linux Socket Programming by Example", Que, 1st edition, 2000.

REFERENCEBOOKS:

1. Graham Glass and King abls, "UNIX for Programmers and Users", Pearson Education, 3rd edition, 1998.

2. M. J. Rochkind, "Advanced UNIX Programming", Pearson Education, 2nd edition, 2004.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computer-networks

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/topic/socket-programming/
2. https://www.coursera.org/courses?query=computer%20network%20programming

SELF-LEARNINGEXERCISES:

Creating TCP clients, Creating TCP servers, Servers handling Multiple clients, Multicast applications.

Course Title	C# and .NET				Course Type		Theory-SC	
Course Code	B20EFS519	Credits	3		Class		VSemester	
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 is geared towards providing students with the knowledge and skills they need to develop C# applications. C# is the core language of the Microsoft .NET framework, designed specifically to take advantage of CLI (Common Language Interface) features. The course focuses on C# program structure, language syntax, and implementation details. It is a simple, object-oriented, and type-safe programming language that is based on the C and C++ family of languages.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss Building Blocks of the .NET Platform.
2. Explain the fundamentals of C# language.
3. Demonstrate the use of the Object Oriented Programming features and Interfaces
4. Illustrate the use of exceptions in real world application.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSO
CO1	Identify the basic components of the .NET Framework.	1 to 5	2
CO2	Develop a program using C# data types for real world applications.	1 to 5	3
CO3	Make use of various interface techniques to invoke interface Members at the object Level	1 to 5	1,3

CO4	Apply exception handling mechanisms of C# for real world applications.	1 to 5	2,3
CO5	Identify Industry defined problem and suggesting solutions using .NET application.	1 to 5	2,3
CO6	Illustrate the use of generics and collections in C#.	1 to 5	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#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	3									3	
CO2	2	3	3	3	3										3
CO3	2	3	3	2	3								3		3
CO4	3	2	3	2	3									3	3
CO5	3	2	2	2	3									3	3
CO6	3	2	3	2	3								3	3	

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

COURSE CONTENT

THEORY:

UNIT - 1

Introducing C# and .NET Platform: The Building Block of the .NET Platform (CLR, CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language, The Role of

.NET Type Metadata, The Role of the assembly Manifest, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime.

UNIT - 2

C# Language Fundamentals: The Anatomy of Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# application, Default assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System. Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C#, String Manipulation in C#, C# Enumerations.

UNIT - 3

Object Oriented Programming and Interfaces: Formal definition of a C# class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo-Encapsulation: Creating Read-Only Fields. The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The "Protected" Keyword, Nested Type Definitions, And the Third Pillar: C #'s Polymorphic Support, Casting Between. Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation. Understanding Callback Interfaces.

UNIT - 4

Exceptions and Interfaces: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handing, The System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System - Level Exception (System. System Exception). Custom Application- Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, Understanding object Lifetime.

TEXTBOOKS:

1. Andrew Troselen; "Pro C# with .NET 3.0", Seventh edition, 2007.

2. E Balaguruswamy: "Programming in C#", 5th reprint, Tata McGraw Hill 2004

REFERENCE BOOKS:

1. Vijay Nicoel, "Visual C#.NET", 5th reprint, Tata McGraw Hill 2004

2. Janice Friedman, "Take Your Coding Skill Set to the Next Level, C Sharp Station", 2019

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/document/1159034
2. https://dl.acm.org/doi/10.5555/948785.948822
3. https://www.sciencedirect.com/science/article/pii/S1875389212002908

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/lecture/develop-windows-apps-gcp/developing-asp-net-mvc-applications-T9XnS
2. https://dotnet.microsoft.com/learn/aspnet
3. https://www.edx.org/learn/c-sharp

SELF-LEARNINGEXERCISES:

1. https://stackify.com/learn-c-sharp-tutorials/
2. https://www.udemy.com/course/c-net-for-beginners/
3. https://www.edureka.co/microsoft-dotnet-framework-self-paced
4. https://www.udemy.com/course/c-sharp-for-beginners/

<table>
<tr><td>Course Title</td><td colspan="4">Multimedia Computing</td><td colspan="2">Course Type</td><td colspan="2">Theory-SC</td></tr>
<tr><td>Course Code</td><td>B20EFS520</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V 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>0</td><td>0</td><td>0</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>00</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This Course provides the knowledge of basic concepts of Multimedia and Hypermedia, World Wide Web, overview of Multimedia Software Tools , multimedia applications,graphics , image data representation, color inimage and video, types of video signals and basics of digital audio multimedia operating Systems. It also provides knowledge of Quality of Service, compression standards, Network Protocols for multimedia communication and multimedia over wireless networks.

COURSE OBJECTIVE (S): The objectives of this course are to:

1. Explain the basic concepts of Multimedia and Hypermedia, World Wide Web, and Overview of Multimedia Software Tools and exploring multimedia applications.
2. Demonstrate graphics and image data representation, color in image and video and types of video signals and basics of digital audio.
3. Discuss and describe the current and future issues related to multimedia technology.
4. Illustrate practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary hardware and software technologies.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Apply different compression techniques depending on the multimedia objectstreams, interpret the various standards for multimedia communications andtheir features	1 to 4, 9, 12	1

CO2	Demonstrate multimedia and its applications to potential clients.	1 to 3,5,9,12	2
CO3	Identify requirements and constraints for a good Quality of service in multimedia environment	1 to 3,5,9, 12	3
CO4	Design and develop applications and exercise proper design choices and meetQuality of Service requirements.	1 to 5, 9, 12	2,3
CO5	Illustrate different Synchronization techniques used by Operating system for process management.	1 to 5	1,2
CO6	Apply Digitization and Quantization methodinthe real-time multimedia network applications.	1 to 5	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 ARTICULATION MATRIX

CO#/	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	2	3	3	3	2								3	3	
CO6	3	3	2	3	3									3	3

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Multimedia: What is Multimedia? Multimedia and Hypermedia, World Wide Web, Overview of Multimedia Software Tools.

Graphics and Image Data Representation: Graphic/ Image Data Types, Popular File Formats.

Color in Image and Video: Color Science, Color Models in Images, Color Models in Video.

UNIT – 2

Fundamental Concepts in Video: Types of Video Signals, Analog Video, Digital Video.

Basics of Digital Audio: Digitization of Sound, MIDI: Musical Instruments Digital Interface, Quantization and Transmission of Audio.

UNIT – 3

Introduction - Interdisciplinary Aspects of Multimedia

Quality of Service: Requirements and Constraint, Quality of Service Concepts, Resources, Establishment Phase, Run-time Phase of Multimedia Call, QoS Management Architectures.

UNIT – 4

Multimedia Operating Systems: Process Management, Interposes Communication and Synchronization, Memory Management, Device Management, System Architecture.

TEXTBOOKS:

1. Li, Ze-Nian, Drew, Mark S., Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, Firstedition, 2014.

2. Steinmetz, Ralf, Nahrstedt, Klara, "Multimedia Systems" Springer, Second edition, 2004

REFERENCEBOOKS:

1. Fred Halshall "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson education, Second edition, 2007.

2. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education, Sixth edition, 2008.

JOURNALS/MAGAZINES:

1. https://www.guide2research.com/journals/web-mobile-multimedia
2. https://dl.acm.org/journal/tomm
3. ACM, ACM Transactions on Multimedia Computing, Communications, and Applications

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/lecture/internet-of-things-multimedia/multimedia-computing-and-classification-KRa30
2. https://www.aonlinetraining.com/multimedia_courses_elearning_training_department.html

SELF-LEARNINGEXERCISES:

1. Social Media Sharing- Representative Social Media ServicesMore exploration on GIThub
2. User-Generated Media Content SharingC modules interface

3. Media Propagation in Online Social Networks

Course Title	Web and Text Mining				Course Type		Theory-SC	
Course Code	B20EFS521	Credits	3		Class		VSemester	
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:

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 OBJECTIVE (S):

The objectives of this course are to:

1. Discuss various data mining techniques for different applications.
2. Describe different clustering techniques for text data.
3. Demonstrate the classification techniques for text data.
4. Illustrate web data retrieval techniques.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs

CO1	Choose the Data mining techniques to extract data from given dataset.	1 to 5	1
CO2	Apply appropriate classification algorithm to analyze the given data.	1 to 5	2
CO3	Identify suitable Web Mining technique to perform social network analysis.	1 to 5	1,2
CO4	Design web crawlers for information retrieval from web.	1 to 5	2,3
CO5	Apply relevant machine learning models for analyzing textual data and correctly interpreting the results	1 to 5	1,3
CO6	Make use of basic methods for information extraction and retrieval of textual data	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT- 1

Introdution to Data Mining Techniques:

Text Extraction and Document Clustering. Introduction to data mining, Classification, Clustering, Association Analysis, Introduction to key extraction methods, Rapid automatic keyword extraction, Benchmark evaluation, Stop list generation, Evaluation on news articles, Algebraic techniques for multilingual document clustering: Introduction, Experimental setup, Multilingual LSA.

UNIT -2

Text Data Classification: Content-based spam email classification using machine-learning algorithms: Introduction, Naive Bayes, Logit Boost, Support vector machines, Augmented latent semantic indexing spaces, Radial basis function networks, Data pre-processing, Feature selection, Message representation,

Evaluation of email classification, utilizing nonnegative matrix factorization for email classification problems: Introduction, Nonnegative matrix factorization.

UNIT- 3

Web Mining - I: Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Link Analysis: Social Network Analysis, Co-Citation and Bibliographic Coupling.

UNIT- 4

Web Mining - II: Web Crawling: A Basic Crawler Algorithm: Breadth-First Crawlers, Preferential Crawlers, Implementation Issues: Fetching, Parsing, Stop word Removal and Stemming Link Extraction and Canonicalization, Spider Traps, Page Repository, Concurrency, Universal Crawlers: Scalability, Coverage vs Freshness vs Importance, Focused Crawlers, Topical Crawlers: Topical Locality and Cues.

TEXTBOOKS:

1. Michael W. Berry and Jacob Kogan, “Text Mining: Applications and Theory”, Wiley, 2010
2. Bing Liu, “Web DataMining: Exploring Hyperlinks, Contents and Usage Data”, Springer, 2007.

REFERENCEBOOKS:

1. Jiawei Han, MichelineKamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier, 2011.

JOURNALS/MAGAZINES:

1. ACM Transactions on Knowledge Discovery from Data (TKDD)
2. 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-LEARNINGEXERCISES:

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

<table>
<tr><td>Course Title</td><td colspan="4">Deep Learning and Reinforcement Learning</td><td colspan="2">Course Type</td><td colspan="2">Theory-SC</td></tr>
<tr><td>Course Code</td><td>B20EFS522</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="6">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>-</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>-</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:

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. The idea of learning online is extremely powerful and is a defining feature of Reinforcement Learning. Implementation of neural network learning system to solve an infinite state control task including Siri's speech recognition, Face book's tag suggestions and self-driving cars.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the basic concepts of Reinforcement learning and Deep learning.
2. Analyze the mathematical and algorithmic concepts related to Reinforcement learning.
3. Demonstrate the use of SARSA and Q-learning and Reinforcement learning.
4. Apply Dynamic programming to address the real time problems.
5. Identify the characteristics of a well-defined policy in Reinforcement Learning
6. Apply policy iteration to compute optimal policies in Reinforcement Learning

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Outline the basic concepts of Reinforcement Learning and Deep learning.	1 to 5	1
CO2	Make use of mathematical and algorithm concepts inReinforcement Learning.	1 to 5	2
CO3	Utilize SARSA and Q-learning in Reinforcement Learning.	1 to 5	1,2
CO4	Analyze the setting in which dynamic programming can be applied	1 to 5	2,3
CO5	Understand the basic Concepts of artificial neurons and perceptron learning algorithm	1 to 5	2
CO6	Understand the relation between rewards and goal of an agent	1 to 5	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#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	2								3		
CO2	1	2	3	3	2									3	
CO3	3	1	2	3	1								3	3	
CO4	3	1	3	3	2									3	3
CO5	1	2	3	3	2									3	
CO6	1	2	3	3	2									3	

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

COURSE CONTENT

THEORY:

UNIT-1:

Introduction to Deep Learning: Structure of Neurons – the building blocks of deep learning, feed forward neural network, architectural considerations in deep learning, convolutional neural network-deep learning for vision. Basic concepts of artificial neurons, single and multi layer perceptron, perceptron learning algorithm, its convergence proof, different activation functions, softmax cross entropy loss function.

UNIT-2:

Introduction to Markov Decision Processes: Understand Markov Decision Processes,graphical representation of a Markov Decision Process, Goal of Reinforcement Learning, Relation between rewards and goal of an agent, Understand episodes and identify episodic tasks, Values Functions & Bellman Equations

UNIT-3:

Optimal Policies & Value Functions: Recognize that a policy is a distribution over actions for each possible state, Describe the similarities and differences between stochastic and deterministic policies, Identify the characteristics of a well-defined policy, Generate examples of valid policies for a given MDP, Describe the relationship between value functions and policies, Create examples of valid value functions for a given Markov Decision Processes

UNIT-4:

Dynamic Programming: Policy Evaluation (Prediction), Outline the iterative policy evaluation algorithm for estimating state values under a given policy, Apply iterative policy evaluation to compute value functions, Use a value function for a policy to produce a better policy for a given MDP, Apply policy iteration to compute optimal policies and optimal value functions, Generalized Policy Iteration.

TEXT BOOKS:

1. MohitSewak,"DeepReinforcementLearning–FrontiersofArtificialIntelligence",SpringerNatureSingaporePvtLtd, 2019.
2. Nikhil Buduma, NocholasLacascio, “Fundamentals of Deep Learning”, First Edition, O’Relly Media,2017.
3. Reinforcement Learning: An introduction (Second Edition) by Richard S. Sutton and Andrew G. Barto, 2015, MIT Press.

REFERENCE BOOKS:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning", First edition, AnMIT

Press book in preparation,2015.

2. Bob story, “Reinforcement Learning with Python”, Logan styles,2017.
3. Engr.S.M.Farrukh Akhtar, “Practical Reinforcement Learning”, Packt Publisher,2017.

JOURNALS/MAGAZINES:

1. IEEE Transactions on Neural Networks and Learning System
2. IEEE Transactions on Pattern Analysis and MachineIntelligence
3. Springer Journal of DeepLearning.
4. Elsevier journal on Deep learning Based IntelligentSystems
5. ACM Jounral on Machine LearningResearch

SWAYAM/NPTEL/MOOCS:

1. https://onlinecourses.nptel.ac.in/noc20_cs11/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs53/preview
3. Fundamentals of Reinforcement Learning, University of Alberta, Alberta Machine Intelligence Institute: https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

SELF-LEARNING EXERCISES:

1. Policy based Reinforcement learning approaches, Actor-Citric Models and A3C.

Course Title	Modern Databases				Course Type		HC	
Course Code	B20EF0504	Credits	2		Class		V Semester	
Modern Database	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**2**	**2**	**26**		**50**	**50**

COURSE OVERVIEW:

This course provides overview of databases, introducing database history, modern database systems, the different models used to design a database, and Structured Query Language (SQL), No SQL, MongoDB used to access and manipulate databases. After completion of the course, the students will be able to understand and cope successfully with various aspects of data management in modern database systems.

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

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of DBMS and SQL in real world applications	1 to 5,9,10,12	1
CO2	Develop programs with Object oriented concepts and object relational databases in real world applications.	1 to 5,9,10,12	1,2
CO3	Classify fundamental concepts in the context of a number of different NOSQL products	1 to 5,9,10,12	3

CO4	Apply MongoDB tools to develop and deploy the applications.	1 to 5,9,10,12	3
CO5	Construct web applications using web frameworks and NOSQL.	1 to 5,9,10,12	1,3
CO6	Illustrate different data modeling techniques in MangoDB and SQL.	1 to 5,9,10,12	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			√			
CO4			√			
CO5		√				

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	2				3	3		2	3		
CO2	2	2	3	2	2				3	3		2	3	3	
CO3	3	1	2	1	2				3	3		2			3
CO4	3	2	2	2	2				3	3		2			3
CO5	2	3	3	3	3				3	3		2	3		3
CO6	3	3	2	3	3				3	3		2		3	3

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

COURSE CONTENT

THEORY:

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

MongoDB concepts: Overview of MongoDB, advantages, data modelling, data types, create and drop database

UNIT – 3

Introduction to NOSQL: Definition of NOSQL, History of NOSQL and Different NOSQL products, Exploring MongoDB, Java/Ruby/Python, Interfacing and Interacting with NOSQL

UNIT – 4

Working with NOSQL: Surveying Database Internals, Migrating from RDBMS to NOSQL, Web Frameworks and NOSQL, using MySQL as a NOSQL

TEXTBOOKS:

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.
3. Shakuntala Gupta Edward, "Practical Mongo DB " Second edition, Apress Publications, 2016, ISBN 1484206487

REFERENCEBOOKS:

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. David Hows, "The definitive guide to MongoDB", 2nd edition, Apress Publication, 2009, 8132230485.

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-LEARNINGEXERCISES:

1. Data warehousing, Data Marts, Getting data into the warehouse More exploration on GIThub
2. Data warehousing &KM , Data warehousing & CRM C modules interface

Course Title	Web Technologies Lab				Course Type		HC	
Course Code	B20EF0505	Credits	1		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**2**	**2**			**25**	**25**

Course Description:

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 PHP and Java Scripts

COURSE OBJECTIVE (S):

1. Build dynamic web pages with the help of various HTML tags and perform validation using Java Script objects by applying different event handling mechanisms.
2. Comprehend the importance of CSS in designing a creative and dynamic website and embedding Java Script code in HTML.
3. Understand and be able to develop JavaScript code to access the DOM structure of web document and object properties.
4. Develop dynamic web pages with usage of server-side scripting.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of HTML tags and CSS to build web pages for various applications.	1- 3,5 ,9-12	1,2,3
CO2	Demonstrate the usage of form data to validate the correctness of given input.	1-3,9-12	1,2
CO3	Apply the variety of presentation effects in HTML documents, including explicit positioning of elements using CSS.	1-5,10-12	1,2,3
CO4	Prepare a HTML document for Interactive webpage using JavaScript.	1-5,10-12	1,2,3
CO5	Apply the concepts of server side technologies for dynamic web applications.	1-5,10-12	1,2,3

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

CO6	Illustrate the concept of php with database connectivity.	1-5,10-12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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	2	1	1	1
CO2	2	2	3						2	1	2	2	2	2	
CO3	3	3	2	2	1					2	1	2	2	2	1
CO4	2	3	2	3	1					2	1	2	2	2	1
CO5	2	3	2	2	1					2	1	2	2	2	1
CO6	2	3	2	2	2					2	1	2	3	3	3

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 consume 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 webpages for an online Bookstore.The pages should resemble like Error! Hyperlink reference not valid. Website should consist of Homepage, Registration & Login, User profile page, Books catalog, Shopping cart, Payment by credit card, and order confirmation.	HTML,CSS	Required basic skills html tags
2.	Write an HTML page that has one input, which can take multi line text and a submit button. Once the user clicks the submit button, it should show the number of characters, words and lines in the text entered using an alert message. Words are separated with white space and lines are separated with new line character.	HTML, Javascript	
3.	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	HTML, Javascript	Required basic skills html tags and Java script

	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, Semester, SRN, date of admission, email id and check for validity or correctness of the input data by writing a JavaScript to validate thesefields.		
4.	Most of the organizations are conducting online tests for the placements. Similarly, online courses are conducting tests immediately after the course online to display the score instantly. Create an html page to show online exam using JavaScript. Let the page displays four Questions and have four optional answers using radio buttons and by clicking submit button display the score in an alert box.Reset the page into initial condition for nextexam.	HTML, Javascript	Required basic skills HTML tags and Java script
5.	Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: a) Input: Click on Display Date button using onclick( ) function Output: Display date in the textbox b) Input: A number n obtained using prompt Output: Factorial of n number using alert c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert	HTML, Javascript	Required basic skills HTML tags and Java script
6.	PHP is a server scripting language, tool for making and powerful dynamic and interactive Web pages. Write a PHP program to store current date-time in a COOKIE and display the Last visited on date-time.	Web server, WAMP, XAMPP, LAMPP	Requires basics of PHP scripting
7.	PHP (recursive acronym for PHP: Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML. Write a PHP program to store	Web server, WAMP, XAMPP,	Requires basics of PHP scripting

	page views count in SESSION, to increment the count oneach refresh, and to show the count on web page.	LAMPP	
8	In any business organization, employees keep traveling across different geographical locations and at the same time they want to be connected to 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 web page to search for a book based on book title specified by the user and displays the search results with proper headings.	Web server, WAMP, XAMPP, LAMPP to connect MySQL database	Requires basics of MySQL and PHP scripting

Course Title	Computer Networks lab				Course Type		HC	
Course Code	B20EF0506	Credits	1		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**26**	**25**	**25**

COURSE OVERVIEW:

This course introduces to networking and Internet protocols via programming and hands-on labs using different tools viz. ns3, NMAP, packet tracer. The concept learnt are understood more clearly pertaining to TCP/IP protocol architecture; user datagram protocol (UDP); multicasting; transmission control protocol (TCP); standard Internet services, and protocol usage by common Internet applications. Sockets programming; client/server; peer-to-peer; Internet addressing; TCP sockets; UDP sockets; Router and switch configurations, network topology, wireless internetworking, Network protocol analyzers; traffic generation...

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the ns3 simulator, installation and its application.
2. Illustrate the creation of point to point link, TCP, UDP protocols its connection.
3. Demonstrate the connection establishment of network computing devices.
4. Discuss tracking, testing, analyzing the network.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the protocol stacks (OSI and TCP/IP) used for data communication	1 to 5,9,10,12	1,3
CO2	Analyze the connection establishment of network computing devices using Packet tracer	1 to 5, 9,10,12	1,3
CO3	Develop a program for star topology in C++ and understand data transfer with NetAnim	1 to 5, 9,10,12	2, 3

CO4	Make use of TCP dump to understand and analyze the network characteristics	1 to 5, 9,10,12	1,3
CO5	Apply NMAP to understand network behavior for spurious activity	1 to 5, 9,10,12	1,3
CO6	Demonstrate the wireshark tool for protocol analysis	1 to 5, 9,10,12	1,2,3

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 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				3	3		2	3		3
CO2	3	3	2	2	1				3	3		2	3		3
CO3	3	3	2	2	2				3	3		2	1	1	3
CO4	3	3	3	1	2				3	3		2	1	-	3
CO5	3	2	2	2	3				3	3		2	3		3
CO6	3	2	2	3	3				3	3		2	3	2	3

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Introduction to: (a) discrete event simulation, (b) ns3, (c) ns3 Installation, (d) NetAnim.	NS3,NetAnim,Nmap	Understand the meaning of dicrete event simulatior like NS3.Gain knowledge to install the ns3 software in

			Ubuntu.Understand NetAnim and its installation.
2	Write a NS3 program to connect two nodes with a point to point link, which have unique interface. Analyze the network performance using UDP client server.	NS3(Installed with NetAnim), Wireshark.	Understand to establish point to point network. Create an interface to point to point link. Anylize the Network performance usibg client server
3	Write a NS 3 program to demonstrate bus topology. Analyze the performance using UDP based applications.	NS3(Installed with NetAnim), Wireshark.	Create Bus Topology. Analyze the performance using UDP based applications.
4	Write a NS 3 program to demonstrate star topology. Analyze the performance using UDP based applications.	NS3, Wireshark	Create Star Topology. Analyze the performance using UDP based applications
5	Write a NS3 program to implement FTP using TCP bulk transfer, Analyze the performance	NS3, Wireshark.	Impliment FTP protocol to analyze the flow of bulk transfer. Anlyze the performance of Application Protocols.
6	Write a NS3 program to connect two nodes with a point to point link, which have unique interface. Analyse the traffic control using TCP by changing suitable parameters.	NS3, Trace Matices, Wirushark	Create Point to point link with unique interface. Analyze the flow of traffic control of Application Protocols.
7	Write NS 3 Program to configure two nodes on an 802.11b physical layer, with802.11b NICs in adhoc mode, and by default, sends one packet of 1000 (application) bytes to the other node. The physical layer is configured to receive at a fixed RSS (regardless of the distance and transmit power); therefore, changing position of the nodes has no effect. Analyze the performance.	NS3(Installed with NetAnim and Wifi Libraries)	Implement the wireless Technology in Adhoc mode. Anayze the performace by changing the position of nodes.
8	Install wireshark, and analyze the packets using it on a selected interface. Apply filters and check the packets.	Wireshark, I/O Graph Tools.	Install the wireshark tool for packet analysis. Apply the filters and anlysze the packet parameters.
9	Install packet tracer, and consider a topology and configure VLAN	Packet Tracer	Install the Packet tracer. Create and Configure a simple Virtual Local Area Network(VLAN)
10	Install NMAP, and execute atleast 10 commands to demonstrate the scanning of networks hosts and ports.	NMAP, Commands to Scan the system.	Install Nmap in both Windows and Ubantu Platform. Demonstrate the scanning of networks hosts and ports using suitable commends.

TEXTBOOKS:

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

Course Title	Machine Learning lab				Course Type		H C	
Course Code	B20EF0507	Credits	2		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**26**	**25**	**25**

COURSE OVERVIEW:

This course gives an overview of many machine learning concepts, techniques and algorithms beginning with topics such as classification and linear regression and ending up with more recent topics such support vector machines. Also, students will learn to analyze the data and predict the results.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Apply the mathematical and statistical prospective of machine learning algorithms through python programming.
2. Analyze machine learning algorithms to predict individual income, medical data & more
3. Execute Python program to design and implement classifiers for machine learning applications.
4. Analyze model generated from various dataset.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Implement various data processing operations and evaluate predictionresults.	1,3,4,5,8,9,10, 12	1,2,3
CO2	Execute K-mean clustering to perform segmentation.	1,3,4,5,8,9,1012	1,2,3

CO3	Evaluate supervised machine learning algorithm to predict classes	1 to 5,8,9,10,12	1,2,3
CO4	Assess regression algorithms for predicting continuous values.	1 to 5,8,9,10,12	1,2,3
CO5	Examine efficiency of linear classifier on aforesaid data set	1 to 5,8,9,10,12	1,2,3
CO6	Create a mini project to address data optimization techniques in retailindustry	1 to 5,9,10,11,12	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**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2		1	2	2			1	2	2		2	3	2	2
CO 2	2		1	1	2			1	2	2		2	3	2	2
CO 3	3	2	2	2	2			1	2	2		2	3	2	2
CO 4	3	2	2	2	2			1	2	2		2	3	3	2
CO 5	3	2	2	2	2			1	2	2		2	3	2	2
CO 6	3	3	3	3	3			1	3	2	3	3	3	3	3

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

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	Write a python program to predict income levels of adultindividuals using a linear regression model. The process includes training, testing and evaluating the model on theAdult dataset. In this sample experiment you need to traina classifier on the Adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets/master/adult-all.csv	Anaconda ,PyCharm	Python Programmingskills
2.	Write a python code to cluster similar companies into same group given their Wikipedia articles and can be usedto assign cluster to new company. The students are expected to demonstrate how to use the K-Means clustering algorithm to perform segmentation on companies from the Standard & Poor (S&P) 500 index, based on the text of Wikipedia articles about each company. Refer the following link (S&P) 500 index: https://en.wikipedia.org/wiki/List_of_S%26P_500_companies	Anaconda ,PyCharm	Python Programming skills
3.	Write a python program to classify the medical dataset using KNN. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Medical Data set:https://lionbridge.ai/datasets/18-free-life-sciences- medical-datasets-for-machine-learning/	Anaconda ,PyCharm	Python Programming skills

4.	Write a python code to predict the real estate sales price of a house based upon various quantitative features about the house and sale. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the real estate salesprice of a house Data set: https://data.world/datasets/real-estate	Anaconda ,PyCharm	Python Programming skills

5.	Write a python program to predict income levels of adult individuals using Decision Tree Regression Model. The process includes training, testing and evaluating the model on the Adult dataset. In this sample experiment you need to train a classifier on the Adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstratehow you can perform basic data processing operations, split the dataset into training and test sets, train themodel, score the test dataset, and evaluate the predictions. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets /master/adult-all.csv	Anaconda, PyCharm	Python Programming skills
6.	Write a python program to predict income levels of adult individuals using Support Vector Machine Regression Model. The process includes training, testing and evaluating the model on the Adult dataset. In this sampleexperiment you need to train a classifier on the Adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets /master/adult-all.csv	Anaconda, PyCharm	Python Programming skills

7.	Write a python program to classify the medical dataset using Multilayer Perceptron Classifier. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Medical Data set:https://lionbridge.ai/datasets/18-free-life-sciences- medical-datasets-for-machine-learning/	Anaconda, PyCharm	Python Programming skills
8.	Write a python program to classify the medical dataset using Gaussian Naïve Bayes Classifier. The students are expected to demonstrate how you can perform basic dataprocessing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Medical Data set: https://lionbridge.ai/datasets/18-free-life-sciences-medical-datasets-for-machine-learning/	Anaconda, PyCharm	Python Programming skills
9.	Compare the performances of the classification models that you implemented to classify the medical dataset. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions. Refer the following link to download the Medical Data set:https://lionbridge.ai/datasets/18-free-life-sciences- medical-datasets-for-machine-learning/	Anaconda, PyCharm	Python Programming skills
10.	Consider the publicly available banknote authentication Data Set on the UCI machine learning repository. Implement the deep learning classifier to classify the aforesaid data set. Refer the following link to download the Medical Data set: https://archive.ics.uci.edu/ml/datasets/banknote+authentication	Anaconda, PyCharm	Python Programming skills
	Part-B		
	Mini Project		

1	**Retail Price Optimization using Machine Learning** In this machine learning pricing project, implement a retail price optimization algorithm using regression trees. This is one of the first steps to building a dynamicpricing model. Pricing a product is a crucial aspect in any business. A lotof thought process is put into it. There are different strategies to price different kinds of products. There areproducts whose sales are quite sensitive to their prices and as such a small change in their price can lead to noticeable change in their sales. While there are products whose sales are not much affected by their price - these tend to be either luxury items or necessities (like certain medicines). This machine learning retail price optimization project will focus on the former type of products. Price elasticity of demand (Epd), or elasticity, is the degree to which the effective desire for something changes as its price changes. In general, people desire things less as those things become more expensive. However, for some products, the customers desire could drop sharply even with a little price increase, and for other products, it could stay almost the same even with a big price increase. Economists use the term elasticity to denote this sensitivity to price increases. More precisely, price elasticity gives the percentage change in quantity demanded when there is a one percent increase in price, holding everything else constant.	To implement a retail price optimization algorithm using regression trees	Python Programmingskills

	In this machine learning pricing optimization case study,we will take the data of a cafe and based on their past sales, identify the optimal prices for their items based on the price elasticity of the items. For each item, first the price elasticity will be calculated and then the optimal price will be figured. While this is taking a particular cafe data, this work can be extended to priceany product. Briefly, price optimization uses data analysis techniquesto pursue **two main objectives**: Understanding how customers will react to different pricing strategies for products and services, i.e., understanding the elasticity of the demand. Finding the best prices for a given company, consideringits goals. Pricing systems have evolved since the early 1970s until now, from applying very simple strategies, such asa standard markup to base cost, to being capable of predicting the demand of products or services and finding the best price to achieve the set KPI. Price optimization techniques can help retailers **evaluate the potential impact of sales promotions** or **estimate the right price** for each product if they want to **sell it in a certain period oftime**. **Modules:** CompetitionWeather Season Special events / holidays Macroeconomic variablesOperating costs Warehouse information To **determine**: The initial price The best price The discount price The promotional price		

Course Title	Modern Databases Lab	Course Type	HC

Course Code	B20EF0508	Credits	1		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**26**	**25**	**25**

COURSE OVERVIEW:

The course gives an hands-on experience on - DDL, DML commands, Query processing using operators, Joins, Views, Synonyms, Indexes, Single row functions, Group functions and Set functions. It also offers the programming concepts of PL/SQL and mongoDB.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain database applications, data models, schemas and instances.
2. Demonstrate the use of constraints and relational algebra operations.
3. Emphasize the importance of normalization in databases.
4. Familiarize issues of concurrency control and transaction management.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the requirements of a given database problem and design viable ER-Models.	1 to 3,6,9,10,12	1,2
CO2	Create database schemas, select and apply suitable integrity constraints for querying databases using SQL interface.	1 to 6, 9,10,12	1,2
CO3	Apply DDL, DML commands on different database schema.	1 to 4, 9,10,12	1,2
CO4	Develop database applications such as Product Order System, Employee DatabaseSystem using modern tools(mongoDB).	1 to 6, 9,10,12	1,2,3
CO5	Develop and interpret PL/SQL blocks to centralize database applications formaintainability and reusability.	1 to 6, 9,10,12	1,2,3
CO6	Design and develop database application based on real life problemto address societal issues using various database management tools.	1 to 6, 9,10,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

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.
	b)To practice with the DML Commands	SQL / Oracle	Create and perform operations on Tuples.
2	**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".	SQL / Oracle	Create and perform operations.

	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** 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)	SQL / SQL Server	Create and perform operations
	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.		

4.	Create an employee database with the fields: {eid, ename, dept, desig, salary, yoj, address {dno, street, locality, city}}	MongoDB	Createand perform operations
5.	Create a Book Data Base with the fields: (ISBN, bname, author [], year, publisher, price) use Book.	MongoDB	Create and perform operations
6.	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})	MongoDB	Create and perform operations
	Part-B - Mini Project **E-Commerce Management System**		
	In this modern era of online shopping no seller wants to be left behind, moreover due to its simplicity the shift from offline selling model to an online selling model is witnessing a rampant growth. Therefore, as an engineer our job is to ease the path of this transition for the seller. Amongst many things that an online site requires the most important is a database system. Hence in this project we are planning to design a database where small clothing sellers can sell their product online. ***Modules:*** **User** Add user Delete user Search user Modify user **Transaction** Place order Deliver the order View the transactions **Product** Add product Delete product Search product View product • A new user can register on the website. • A customer can see details of the product present in the cart • A customer can view his order history. • Admin can start a sale with certain discount on every product. • Customer can filter the product based on the product details. • A customer can add or delete a product from the cart.	MySQL: SQL commands PL/SQL Triggers	Draw the E-R diagram and to perform its operations. **Implementation** Creating tables Inserting data **Queries** Basic queries PL/SQL Trigger function

	• A seller can unregister/ stop selling his product. • A seller/ customer can update his details. • Admin can view the products purchased on particular date. • Admin can view number of products sold on a particular date. • A customer can view the total price of product present in the cart unpurchased. • Admin can view details of customer who have not purchased anything. • Admin can view total profit earned from the website.		

Course Title	Indian Tradition and Culture				Course Type	Theory-FC	
Course Code	B20PA0501	Credits	1		Class	V Semester	
Course Structure	TLP	Credits	Contact Hours	WorkLoad	Total Number of Classes Per Semester	Assessment in Weightage	
	Theory	1	1	1			
	Practice	0	0	0	Theory	CIE	SEE
	Tutorial	-	-	-			
	Total	**1**	**1**	**1**	**13**	**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 (S):

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)

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

CO#	CourseOutcomes	POs	PSOs
CO1	Gain conceptual understanding of Indian culture and traditions.	2,3,4,6,8,12	
CO2	Describe various ancient theories in treatment of any disease.	10,11	
CO3	Appreciate the science and technological advancements in ancient India.	11	
CO4	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.	11,12	
CO5	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food	2-6,10,11	
CO6	Understand India as a land united by cultural diversity	2-6,10,11	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Indian Tradition

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 Religion – Pre-vedic and Vedic religion, Jainism, Buddhism, Hinduism, Religious Reform Movements, Advent of Christianity Art – Introduction to Natyashastra, classical and contemporary art forms (dance and music), regional art forms (dance and music), Folk art, puppetry Architecture – Engineering and Architecture in Ancient India; Evolution of Hindu Temple Structures, Sculptures, Coins and Pottery from Ancient India Literature- Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.

UNIT – 2

Contribution of ancient India to Science and Maths

Development of Science in Ancient India- Astronomy, Mathematics, Medicine, Metallurgy. Scientists of Ancient India: Mathematics and Astronomy- Baudhayan, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya Science- Kanad, Varahamihira, Nagarjuna Medical Sciences (Ayurveda and Yoga)- Susruta, Charaka, Yoga and Patanjali Science and Scientists in Medieval India- Mathematics, Biology, Chemistry, Astronomy, Medicine, Agriculture. 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

Hindu Spirituality based on shruti and smriti- Hinduism in General, Basic notions of Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita. 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 Buddhist, Jaina Spiritualities- Main Doctrines of Buddhism: Four Noble Truths (Arya Satya), Concept of Nirvana - Ashtanga Marga.

UNIT – 4

Unity in Diversity

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. 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 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

REFERENCES 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	Skill development-1				Course Type	HC	
Course Code	B20EF0509	Credits	2		Class	VSemester	
Course Structure	TLP	Credits	Contact	Work LoadLoa	Total Number of Classes Per Semester	Assessment in Weightage	
	Theory	2	4	-			
	Practice	-	-	-	Theory	CIE	SEE
	Tutorial	**-**	**-**	**-**			
	Total	**2**	**4**	**-**	**-**	**-**	**-**

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3

CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Skill development-1:

Students will be offered training and certifications on the trending technologies from the industry experts.

The students are evaluated and certified after the training programs.

Open Elective-I:

Course Title	Database Management Systems				Course Type		Theory-OE	
Course Code	B20CSO501	Credits	3		Class		V 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:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSO
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	Construct the physical and logical database designs, database modeling, relational, hierarchical, and network models.	1to 5,12	1,3
CO6	Relate conceptual model torelational model and formulaterelational algebra	1to 5,12	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 ARTICULATION MATRIX

CO#/	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	3	3	3							1	3		3
CO6	3	3	2	3	3							1		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.

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

REFERENCEBOOKS:

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-LEARNINGEXERCISES:

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

VI SEMESTER

Course Title	Theory of Computation	Course Type	HC

Course Code	B20EF0601	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	0	0	0	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 automation, and Turing machine which form basic models of computation also the foundation of many branches of computer science.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Compare 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. Explain computing Machine including PDA and Turing Machine.

COURSE OUTCOMES (COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the Finite State Machine by applying the concepts of DFA and NFA.	1 to 5, 12	1
CO2	Make use of regular expressions for constructing DFA and NFA.	1 to 5,12	2
CO3	Identify ambiguity in grammar and Construct CFG for the given language in Normal Forms.	1 to 5,12	3
CO4	Apply the concepts of Push down Automata and Turing machine for a given Language.	1 to 5,12	2
CO5	Outline the notions of computation, such as algorithm, computability,decidability, reducibility, and complexity, through problem solving.	1 to 5,12	1,2
CO6	Choose mathematical foundations, algorithmic principles and computer science theory to model and design of computer based systems.	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	2	2	1	1	1							1	3		
CO2	2	2	1	1	1							1		3	
CO3	2	2	1	1	1							1			3
CO4	2	2	1	1	1							1		3	
CO5	3	2	3	3	2								3		3
CO6	3	3	2	3	3									3	3

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

COURSE CONTENT

THEORY:

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:

Applications of Finite Automata and Applications of Regular Expressions.

Course Title	**Big Data and Cloud Computing**	**Course Type**	**HC**

Course Code	B20EF0602	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 system architecture, software environment, supporting technologies, and innovative applications of Cloud and Big Data systems are all covered in depth in this course. Students are provided a strong foundation and hands-on experience in order to make engineering decisions for commercial and science applications. The essential principles and important themes of Cloud and Big Data Systems are introduced in this course, including Cloud Computing models and platforms, virtualization, distributed file systems, , and Big Data processing frameworks (Apache Hadoop and Spark). This course will also cover contemporary technology developments and research in cloud computing and big data, with an emphasis on bridging the gap between data analytics and data-driven platforms.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the basics of Cloud Computing and Big Data.
2. Demonstrate the use of Cloud Technologies for Big Data.
3. Illustrate the use of different Cloud-based services for Big Data handling.
4. Demonstrate the use of Spark Big Data platform for Big Data.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the foundation of Big Data enabling Technologiesusedfor the real world applications.	1 to 5,9 10,12	1,2
CO2	Make use of the concepts of Machine Learning to deal with Big Data applications.	1 to 5,9.10,12	1,2
CO3	Build various types of cloud infrastructures corresponding to the real world applicationsdemanding the cloud services.	1 to 5,9,10,12	1,2,3
CO4	Compare and contrast Smart Clouds, Virtualization and Mashup Services in cloud computing.	1to 5,9,10,12	1,2
CO5	Understand the Distributed Functional Programming Model such as Spark to deal with Big Data applications.	1to 5,9,10,12	1,3
CO6	Build scalable applications based on Spark programming model to tackle real world big data problems.	1to 5,9,10,12	1,2,3

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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

Unit-1:

Big Data Science and Machine Intelligence: Enabling Technologies for Big Data Computing, Social-Media, Mobile Networks and Cloud Computing, Big Data Acquisition and Analytics Evolution, Machine Intelligence and Big Data Applications.

Unit-2:

Smart Clouds, Virtualization andMashup Services: Cloud Computing Models and Services, Creation of Virtual Machines and Docker Containers, Cloud Architectures and Resources Management, Case Studies of IaaS, PaaS and SaaS Clouds, Mobile Clouds and Inter-Cloud Mashup Services.

Unit-3:

Introducing Big Data, Hadoop, and Spark: Introduction to Big Data, Distributed Computing, and Hadoop; Introduction to Apache Spark, Functional Programming Using Python. **Understanding the Spark Cluster Architecture:** Anatomy of a Spark Application, Spark Applications Using the Standalone Scheduler, Deployment Modes for Spark Applications Running on YARN.

Unit-4:

Learning Spark Programming Basics: Introduction to RDDs, Loading Data into RDDs, Operations on RDDs. **Advanced Programming Using the Spark Core API:**Shared Variables in Spark, Partitioning Data in Spark, RDD Storage Options, Processing RDDs with External Programs, Data Sampling with Spark,
Understanding Spark Application and Cluster Configuration.

TEXT BOOKS

1. Hwang, Kai, and Min Chen. Big-data analytics for cloud, IoT and cognitive computing. John Wiley & Sons, 2017.
2. Aven, Jeffrey. Data Analytics with Spark Using Python. Addison-Wesley Professional, 2018.

REFERENCE BOOKS:

3. Kshetri, Nir, TorbjörnTorbjörnFredriksson, and Diana Carolina Rojas Torres. Big data and cloud computing for development: Lessons from key industries and economies in the global south. Routledge, 2017.
4. Kane, Frank. Frank Kane's Taming Big Data with Apache Spark and Python. Packt Publishing Ltd, 2017.
5. Luu, Hien. Beginning Apache Spark 2: with resilient distributed datasets, Spark SQL, structured streaming and Spark machine learning library. Apress, 2018.
6. Karau, Holden, et al. Learning spark: lightning-fast big data analysis. " O'Reilly Media, Inc.", 2015.

Sample Assignments for Internal Assessment:

Use Java Programming Language to complete the assignment.

Assignment	Description	Concepts
Manufacturing		
Predictive maintenance	Big data can help predict equipment failure. Potential issues can be discovered by analyzing both structured data (equipment year, make, and model) and multi-structured data (log entries, sensor data, error messages, engine temperature, and other factors). With this data, manufacturers can maximize parts and equipment uptime and deploy maintenance more cost effectively. This data can be used to predict more than just equipment failure. For many manufacturing processes, it's also important to predict the remaining optimal life of systems and components to ensure that they perform within specifications. Falling out of tolerance—even if nothing is broken—can be as bad as failure. For example: in drug manufacturing a faulty, but still	Big Data and Cloud Computing

	functional, component could introduce too much or too little of the active ingredient. **Challenges**: Companies must integrate data coming from different formats and identify the signals that will lead to optimizing maintenance.	
Operational efficiency	Operational efficiency is one of the areas in which big data can have the most impact on profitability. With big data, you can analyze and assess production processes, proactively respond to customer feedback, and anticipate future demands. **Challenges**: Data teams must balance the data volume with the growing number of sources, users, and applications.	Big Data and Cloud Computing
Production optimization	Optimizing production lines can decrease costs and increase revenue. Big data can help manufacturers understand the flow of items through their production lines and see which areas can benefit. Data analysis will reveal which steps lead to increased production time and which areas are causing delays. **Challenges**: Optimizing production requires manufacturers to analyze their production equipment data, material use, and other factors. Combining the different kinds of data can pose a challenge.	Big Data and Cloud Computing
Retail		
Product development	Big data can help you anticipate customer demand. By classifying key attributes of past and current products and then modeling the relationship between those attributes and the commercial success of the offerings, you can build predictive models for new products and services. Dig deeper by using the data and analytics from focus groups, social media, test markets, and early store rollouts to plan, produce, and launch new products. **Challenges**: Companies will have to analyze what can be a high volume of data coming in varying formats, and then create segments according to customer behavior. They will also have to identify sophisticated use patterns and behavior and map them to potential new offerings..	Big Data and Cloud Computing
Customer experience	The race for customers is on. Big data provides retailers with a clearer view of the customer experience that they can use to fine-tune their operations. By gathering data from social media, web visits, call logs and other company interactions, and other data sources, companies can improve customer interactions and maximize the value delivered. Big data analytics can be used to deliver personalized offers, reduce customer churn, and proactively handle issues. **Challenges**: Integrating a high volume of data from various sources can be difficult. Once the data is integrated, path analysis can be used to identify experience paths and correlate them with various sets of behavior.	Big Data and Cloud Computing

Healthcare		
Genomic research	Big data can play in a significant role in genomic research. Using big data, researchers can identify disease genes and biomarkers to help patient's pinpoint health issues they may face in the future. The results can even allow healthcare organizations to design personalized treatments. **Challenges**: The volume of genome data is enormous, and running complex algorithms on the data is complicated and can require long processing times.	Big Data and Cloud Computing
Patient experience and outcomes	Healthcare organizations seek to provide better treatment and improved quality of care—without increasing costs. Big data helps them improve the patient experience in the most cost-efficient manner. With big data, healthcare organizations can create a 360-degree view of patient care as the patient moves through various treatments and departments. **Challenges**: Improving the patient experience requires a large volume of patient data, some of which could be multi-structured data, such as doctor notes or images. Additionally, to analyze patient journeys, path and graph analyses are often needed.	Big Data and Cloud Computing
Healthcare billing analytics	Big data can improve the bottom line. By analyzing billing and claims data, organizations can discover lost revenue opportunities and places where payment cash flows can be improved. This use case requires integrating billing data from various payers, analyzing a large volume of that data, and then identifying activity patterns in the billing data. **Challenges**: Sifting through large volumes of data can be complicated, especially when it comes to integrating different data sources.	Big Data and Cloud Computing

Professional Electives-III

Course Title	High Performance and Quantum Computing			Course Type	Theory-SC
Course Code	B20EFS611	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 goal of this course is to give students solid foundations for developing, analyzing, and implementing parallel and locality-efficient algorithms. This course focuses on theoretical underpinnings. To give a practical feeling for how algorithms map to and behave on real systems and will supplement algorithmic theory with hands-on exercises on modern HPC systems, such as Cilk Plus or OpenMP on shared memory nodes, CUDA for graphics co-processors (GPUs) and OpenMPI for message passing.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain the features of Modern processors and parallel computers.

2.Describe different levels of parallelism along with the synchronization and scheduling.

3.Demonstrate the use of features of OpenMP programming.

4.Ilustrate the use of features of Open MPI programming.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Identify different levels of parallelism that can be applied to solve the given real-world problems.	1 to 5,9,12	1,2,3
CO2	Develop the programs using different levels of parallelism to solve the real-world problems.	1 to 4, 9, 12	1,2,3
CO3	Make use of features of OpenMP to develop parallel programs for solving real world problems	1 to 5,9,12	2,3
CO4	Apply the features of Distributed-memory parallel programming with openMPI for solving real world problems.	1 to 5,9,12	2,3
CO5	Identify different modern Processors to be used in real world application.	1 to 5,9,12	1,2,3
CO6	Apply the features of shared-memory parallel programming with openMP for solving real world problems	1 to 5,9,12	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT- 1

Modern Processors: Stored-program computer architect; General-purpose cache-based microprocessor architecture; Memory hierarchies; Multicore processors; Multithreaded processors; Vector processors.

Parallel computers: Taxonomy of parallel computing paradigms; Shared-memory computers; Distributed-memory computers; Hierarchical (hybrid) systems; Networks.

UNIT -2

Basics of parallelization: Why parallelize; Parallelism; Parallel scalability.

UNIT- 3

Shared-memory parallel programming with OpenMP: Introduction to OpenMP; Case study: OpenMP-parallel Jacobi algorithm; Advanced OpenMP: Wavefront parallelization.

Efficient OpenMP programming: Profiling OpenMP programs; Performance pitfalls; Case study: Parallel sparse matrix-vector multiply.

UNIT- 4

Distributed-memory parallel programming with MPI: Message passing; A short introduction to MPI; Example: MPI parallelization of a Jacobi solver.

Efficient MPI programming: MPI performance tools; Communication parameters; Synchronization, serialization, contention; Reducing communication overhead; Understanding intranode point-to-point communication.

TEXTBOOKS:

1. Georg Hager, Gerhard Wellein," Introduction to High Performance Computing for Scientists and Engineers", CRC Press,2011.

REFERENCEBOOKS:

1.Rohit Chandra, Leo Dagum, DrorMaydan , David Kohr, Jeff McDonald , Ramesh Menon,"Parallel Programming in OpenMP",Morgan Kaufmann,2000

2.Shameem Akhter and Jason Roberts 6," Multi-core programming, Increase performance through software multiyhreading", IEEE Transactions on Knowledge and Data Engineering.

3.Kai Hwang ", Advanced Computer Architecture: Parallelism, Scalability, Programmability", TATA McGraw Hill, 1993

4. George S. Almasi and Alan Gottlieb,"Highly Parallel Computing".

5.Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar," Introduction to Parallel Computing", Addison-Welsey,2003.

JOURNALS/MAGAZINES:

1. International Journal of High Performance Computing Applications, ACM
2. The International Journal of High Performance Computing Applications, sagepub
3. International Journal of High Performance Computing and Networking, Inderscience

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/112/105/112105293/
2. https://nptel.ac.in/courses/106/103/106103206/

SELF-LEARNINGEXERCISES:

The student is expected to study more about the following topics:

1. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

Course Title	Advanced Web Technology				Course Type	Theory-SC
Course Code	B20EFS612	Credits	3		Class	VI Semester
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes	Assessment in

Course Structure	Theory	3	3	3	Per Semester		Weightage	
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

This course covers features of web services , 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 (S):

The objectives of this course are to:

1.Explain the features Client server architecture.

2.Illustrate the use of ASP.Net and Angular JS as front end and MYSQL as backend in real world applications.

3.Demonstrate the use of AJAX and Ruby in real world applications.

4.Discuss the different RESTFul Web Services available for users.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the basic concepts of Client server architecture in real world application.	1 to 5	1,3
CO2	Makeuse of ASP.Net and Angular JS for creating a front end and MYSQL as backend in the development of website.	1 to 5	2,3
CO3	Build a regular expression in ruby to Validate the given real-world data.	1 to 5	2
CO4	Develop an application using the different available RESTFul Web Services.	1 to 5	1
CO5	Make use of JDBC and MySQL concepts for database connection in real world application.	1 to 5	1
CO6	Apply the features of HTTP request and response to build real time web applications.	1 to 5	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 ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT-1

Introduction: Client server architecture in web service, programming model, server controls, data binding, Web Services- Architecting web services – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime, XML, SOAP, DISCO, UDDI.

UNIT-2

ASP.Net and AngularJS : ASP.Net-Overview of .NET Framework, Introduction to C#, ASP.NET, ASP.NET Controls, Web Services, Architectures for Database Access, MYSQL Database System, Database Access with JDBC and MYSQL, AngularJS- The Basics of AngularJS, Databinding and first AngularJS Web Application.

UNIT-3

Ruby and AJAX: 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. Basic

communication techniques – XHR, AJAX with images, Dynamic script loading, Cache control, AJAX patterns-Communication control patterns – predictive fetch, page preloading, submission throttling, periodic refresh, and multi-stage download, Fallback patterns, AJAX libraries – JQuery, JSON.

UNIT-4

Restful Web Services: What Makes RESTful Services Different? - Introducing the Simple Storage Service, Object-Oriented Design of S3, Resources, HTTP Response Codes, An S3 Client, Request Signing and Access Control, Using the S3 Client Library, Clients Made Transparent with Active Resource, Parting Words, The Resource-Oriented Architecture, REST and ROA Best Practices, Ajax Applications as REST Client.

TEXTBOOKS:

1. Ron Schmelzer et al. " XML and Web Services", Pearson Education, 2002.
2. Elizabeth Castro, Bruce Hyslop, "HTML5 and CSS3", 7th Edition, Peachpit Press, 20l2

3.Robert W. Sebesta, P"rogramming the World Wide Web", 4th Edition, Pearson Education, 2008.

4.Nicholas C Zakas et al, "Professional AJAX", 2nd Edition, Wrox publications,2007.

5.Ari Lerner, "The Complete Book on AngularJS", Fullstack.io, 20l3.

6.Leonard Richardson and Sam Ruby, R"ESTFul Web Services", lst Edition, O'Reilly publications, 2007.

REFERENCEBOOKS:

l. Deitel P, Deitel HM," Internet and World Wide Web How To Program", Pearson Education, 20l2

2.AchyutS. Godbole and AtulKahate, "Web Technologies", Tata McGraw Hill, 2003.

3.Jason Hunter, William Crawford, "Java Servlet Programming", O'Reilly Publications, l998.

4.Paul S Wang, SandaKatila," An introduction to Web design and programming Cengage Course, 2003.

JOURNALS/MAGAZINES:

1. ACM Transactions on Internet Technology

2. IEEE International Conference on Enterprise Computing and E-Commerce.

3. ACM Transactions on Information Systems.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
2. https://nptel.ac.in/courses/106/105/106105084/

SELF-LEARNINGEXERCISES:

The student is expected to study more about the following topics:

Rails and Angular JS.

Course Title	Natural Language Processing				Course Type		Theory-HC	
Course Code	B20EFS613	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 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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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.	1 to 5	1
CO5	Make use of Automatic Tagging to find the category of a word.	1 to 5	1,3
CO6	Apply different classification algorithm to solve real world problems.	1 to 5	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#/	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	3	3	2	3								3		3
CO6	2	2	2	2	3								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.

TEXTBOOKS:

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.

REFERENCEBOOKS:

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-LEARNINGEXERCISES:

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

Course Title	Digital Image Processing and Computer Vision				Course Type		Theory-SC	
Course Code	B20EFS614	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	0	0	0	Theory	Practical	CIE	SEE
	-							
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

Computer Vision is one of the fastest growing and most exciting AI disciplines in today's academia and industry. This course is designed to open the doors for students who are interested in learning about the fundamental principles and important applications of computer vision. The course, introduces a number of fundamental concepts in computer vision, expose students to a number of real-world applications that are important to our daily lives. More importantly, students will be guided through a series of well-designed projects such that they will get to implement using few interesting and cutting-edge computer vision algorithms. The course benefit is to apply computer vision algorithms to solve real world problems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of Computer vision
2. Describe various image preprocessing techniques.
3. Demonstrate the use of techniques image transformation and color image processing.
4. Gain expertise in object detection and recognition applications.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
1	Utilize linear filters to enhance the quality of images in given real world application.	1 to 5	1
2	Apply segmentation techniques to solve real world problems.	1 to 5	2
3	Develop image transformation techniques for solving real world problems.	1 to 5	3
4	Makeuse of object detection and recognition techniques to computer vision applications	1 to 5	3
5	Illustrate different filtering technique for Image Restoration and Reconstruction.	1 to 5	1

6	Apply watermarking and image compression techniques in computer vision applications.	1 to 5	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	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	2	3	2	3								3		
CO6	3	2	2	3	3										3

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

COURSE CONTENT

THEORY:

UNIT-1

Introduction: What is Digital Image Processing?, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing

UNIT-2.

Intensity Transformations and Spatial Filtering: Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters, Highpass, Bandreject, and Bandpass Filters from Lowpass Filters, Combining Spatial Enhancement Methods

Filtering in the Frequency Domain: Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Some Properties of the 2-D DFT and IDFT, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering, The Fast Fourier Transform

UNIT-3.

Image Restoration and Reconstruction: Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Image Reconstruction from Projections

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Color Image Smoothing and Sharpening, Using Color in Image Segmentation, Noise in Color Images, Color Image Compression

UNIT-4

Wavelet and Other Image Transforms: Preliminaries, Matrix-based Transforms, Correlation, Basis Functions in the Time-Frequency Plane, Basis Images, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform, Wavelet Transforms

Image Compression and Watermarking: Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding, Symbol-based Coding, Bit-plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding, Digital Image Watermarking

TEXT BOOKS:

1. Rafael C. Gonzalez, University of Tennessee,Richard E. Woods, MedData Interactive, **"**Digital Image Processing**"**, 4th Edition, Pearson **,**2018

REFERENCE BOOKS:

1.David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach" , 2nd Edition, University of Illinois at Urbana-Champaign Jean Ponce, Ecole NormaleSuperieure, Paris©2012, Pearson

2.Richard Szeliski, " Computer Vision: Algorithms and Applications" , Springer

3.David Marr, Tomaso A. Poggio, Shimon Ullman "A Computational Investigation into the Human Representation and Processing of Visual Information", , eBook - Amazon.com

JOURNALS/MAGAZINES:

1. International Journal of Computer Vision, Springer
2. Image and Vision Computing, Elsevier
3. Computer Vision and Image Understanding, Elsevier
4. IEEE Transactions on Image Processing
5. IEEE Transactions on Pattern recognition and machine intelligence

SWAYAM/NPTEL/MOOCs:

1. Computer Vision and Image Processing - Fundamentals and Applications: https://onlinecourses.nptel.ac.in/noc21_ee23/preview
2. Computer Vision: https://nptel.ac.in/courses/106/105/106105216/
3. Deep Learning for Computer Vision: https://nptel.ac.in/courses/106/106/106106224/

SELF-LEARNINGEXERCISES:

1. Artificial Neural Networks, Convolutional Neural Networks.
2. Implementation of applications using the above topics

Professional Electives-IV

<table>
<tr><td>Course Title</td><td colspan="4">Advanced Topics in Networking</td><td colspan="2">Course Type</td><td colspan="2">Theory-SC</td></tr>
<tr><td>Course Code</td><td>B20EFS615</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">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>-</td><td></td><td></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>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

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, high performance networks and data center networks. The goals of the course are to build on basic networking course material in providing an understanding of the tradeoffs and existing technology in building large, complex networked systems, and provide concrete experience of the challenges through a series of lab exercises.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the advanced concepts required for designing the current computer networking
2. Explain the principles of optical networks, wavelength-division multiplexing (WDM), and various network connection types that exist today such as MPLS, ATM etc.
3. Elaborate on how to achieve the performance of a host of critical networking services to data center and enterprise networks
4. Discuss the advanced networking concepts used for transferring voice data over the wireless channel

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.	1 to 4,12	1
CO2	Analyze the concepts of existing protocols to understand the working of advanced protocols.	1 to 4,12	1
CO3	Make use of the topological and routing strategies for an IP based networking infrastructure	1 to 4,12	2

CO4	Extend the working knowledge of datagram and internet socket programming for simulating the real world applications.	1 to 4,12	1
CO5	Identify the different models and architecture used in real world Software-Defined Networking .	1 to 4,12	1
CO6	Apply basic concepts of Wireless Sensor Network to build real world applications.	1 to 4,12	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	2	3	3								1	3		
CO2	3	3	3	3								1	3		
CO3	2	3	3	2								2		3	
CO4	3	2	3	2								1	3		
CO5	3	2	2	3								1	3		
CO6	2	2	3	3								2	3	3	

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

COURSE CONTENT

THEORY:

UNIT – 1

Advanced Router and Switch Architectures: Overview of Router Architecture; Input Port Processor (IPP), Output Port Processor (OPP), Central Controller, Switch Fabric, Multicasting Packets in Routers.

Quality of Service and Scheduling in Routers: Overview of Quality of Service (QoS), Integrated Services QoS, Differentiated Services QoS, Resource Allocation (without mathematical treatment), Packet Scheduling.

UNIT – 2

Tunneling, VPNs, and MPLS Networks: Tunneling, Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks.

All-Optical Networks, WDM, and GMPLS: Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Structure of Optical Cross Connects (OXCs), Routing in All-Optical Networks, Wavelength Allocation in Networks.

UNIT – 3

Asynchronous Transfer Mode: Main features of ATM, Addressing, signaling and Routing, ATM Header structure, IP over ATM.

Software-Defined Networking (SDN) and Beyond: Software-Defined Networking (SDN), SDN-Based Network Model, Small-Size SDN Architectures, SDN Architectures for Clouds, Network Functions Virtualization (NFV), Information-Centric Networking (ICN), Network Emulators for Advanced Networks.

UNIT – 4

Voice over IP (VoIP) Signaling: Public Switched Telephone Networks (PSTN), Overview of Voice over IP (VoIP), H.323 Protocol, Session Initiation Protocol (SIP), Soft switch Methods and MGCP, VoIP and Multimedia Internetworking

Mobile Ad-Hoc Networks: Routing Protocols for Ad-Hoc Networks-DSR, AODV

Wireless Sensor Network: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocol-LEACH, Routing Protocols, Other Related Technologies.

TEXTBOOKS:

1. Nader F. Mir, “Computer and Communication Networks”, Prentice Hall, 2015.
2. Jean Walrand and Pravin Varniya, “High Performance Communication Networks “,second Edition, Morgan Kaufmann Publishers,2011
3. S. Keshav, “An Engineering Approach to Computer Networking”, Pearson Education, 2002
4. William Stalling,” High-Speed Networks and Internets, Performance and Quality of Service”, Second Edition, 2008.

REFERENCEBOOKS:

1. James Kurose and K Ross, “Computer Networking A Top Down Approach”, 6th Edition, 2012
2. IEEE/ACM Transactions Networking
3. Elsevier Computer Networks
4. Springer, Journal of Internet Services and Applications.
5. Elsevier, Journal of Computer Communications.
6. ACM, Computer Communications Review.

JOURNALS/MAGAZINES:

1. http://www.sciencepublishinggroup.com/journal/index?journalid=131
2. https://publons.com/journal/31762/international-journal-on-advances-in-networks-and-/
3. https://www.researchgate.net/journal/International-Journal-on-Advances-in-Networks-and-Services-1942-2644
4. https://www.guide2research.com/journals/network-communication
5. https://benthamscience.com/journals/recent-advances-in-communications-and-networking-technology/

SWAYAM/NPTEL/MOOCs:

1. Coursera – Computer Communications, University of Colorado System.
2. Coursera – Networking in Google Cloud, Google Cloud.
3. https://nptel.ac.in/courses/106/105/106105183/
4. https://www.udacity.com/course/computer-networking--ud436

SELF-LEARNINGEXERCISES:

1. Wifi, WiMax, Bluetooth
2. Mobile Networking Protocols
3. VANET, Sonet, Cloud Networks.

Course Title	Cryptography and Network Security				Course Type		Theory-SC	
Course Code	B20EFS616	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:

Computers around the world are systematically being victimized by rampant hacking. The goal of the ethical hacker is to help the organization take preemptive measures against malicious attacks by attacking the system himself; all the while staying within legal limits. As technology advances and organization depend on technology increasingly, information assets have evolved into critical components of survival. If hacking involves creativity and thinking 'out- of-the-box', then vulnerability testing and security audits will not ensure the security proofing of an organization. To ensure that organizations have adequately protected their information assets, they must adopt the approach of 'defense in depth'. In other words, they must penetrate their networks and assess the security posture for vulnerabilities and exposure. This course helps develops individuals in the specific network security discipline of Ethical Hacking from a vendor-neutral perspective.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of cryptography.
2. Describe public key cryptography and message authentication.
3: Demonstrate the key distribution using Symmetric or Asymmetric encryption.
4. Discuss security applications in the field of Information technology.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the fundamental concepts of cryptography.	1 to 5	1
CO2	Makeuse of public key cryptography and message authentication.	1 to 5	2
CO3	Apply the key distribution technique using Symmetric or Asymmetric encryption.	1 to 5	2,3
CO4	Develop real world security applications in the field of Information technology.	1 to 5	2,3

CO5	Identify the fundamental concepts of OpenSSL	1 to 5	1,2
CO6	Apply the System security concepts for real time secure applications	1 to 5	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 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	3	2	3	2	1								3	3	
CO6	2	1	2	2	2									3	3

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

COURSE CONTENT

THEORY:

UNIT - 1

Introduction: The OSI Security Architecture, Security Attacks, Security Services, mechanisms, A model for network security, symmetric encryption principles, Symmetric Block Encryption Algorithms, Data Encryption Standards, Strength of DES, Triple DES, Advanced Encryption Standard.

UNIT – 2

Public-Key Cryptography and Message Authentication: Public key Cryptographic Principles,PublicKeyCryptographic Algorithms(RSA, Diffie-Hellman),Approaches to Message Authentication, Secure Hash Functions (SHA-512), Message Authentication Codes, Digital Signatures. Introduction to Secure

programming with the OpenSSL API: OpenSSL, Headers and initialization, setting up an unsecured connection, Setting up a secure connection, Error detection.

UNIT – 3

Network Security Applications: Symmetric key distribution using Symmetric encryption, Kerberos(Key Exchange), key distribution using Asymmetric encryption X.509 Certificate Format, Secure socket layer and transport layer security, PGP- Features of PGP, Key Rings in PGP, S/MIME, IP security Overview.

UNIT – 4

System Security: Intrusion Detection, Password Management, Virus and threats, Virus Countermeasures, Firewalls, The Need for Firewalls, Firewall Characteristics, Types of Firewalls. Open-Source Cryptography libraries -a C++98 crypto library, Mhash open-source C library and Crypto ++.

TEXTBOOKS:

1.William Stallings, "Network Security Essentials Applications and Standards", Fourth edition, Prentice Hall, 2011.

2.Behrouz A. Forouzan, "Cryptography and Network Security", McGraw Hill, 2007.

REFERENCEBOOKS:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson, Sixth edition, 2013

2. Joseph MiggaKizza," Guide to Computer Security, Springer Science & Media Inc., Third edition, 2015

3. Andrew S.Tanenbaum, "Computer Networks", Pearson, Fifth edition, 2015.

4. AtulKahate, "Cryptography and Network Security", McGraw Hill, 2013.

JOURNALS/MAGAZINES:

1. Springer Journal of Cryptographic Engineering, ISSN 2190-8508

2. ACM, ACM- International Journal of Applied Cryptography, ISSN:1753-0563

3. IEEE, IEEE Transactions on Information Forensics and Security.

4. Elsevier, Journal of Information Security and Applications.

SWAYAM/NPTEL/MOOCs:

1. Foundations of Cryptography: https://nptel.ac.in/courses/106/106/106106221/
2. Cryptography and Network Security: https://nptel.ac.in/courses/106/105/106105162/

SELF-LEARNINGEXERCISES:

The student is expected to study more about the following topics:

1. IoT complexity leads to security issues and further DDoS attacks, Malware, Cloud security, Roles of AI and machine learning in cyber security.

Course Title	Cloud Computing and DevOps				Course Type		Theory-SC	
Course Code	B20EFS617	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	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

The technological industry is constantly changing. Although the internet was born only a quarter of a century ago, it has already transformed the way that we live. This course provides a practical guide for models to be chosen for deployment, tooling, or using the best practices of the companies. Through the use of Cloud, it will be possible to build the key elements required to efficiently manage and scale the infrastructure, engineering processes, and the applications, with minimal cost and effort.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the various Cloud computing service models, deployment models in virtualized environments
2. Explain the working of cloud computing technologies like data center technology, web technology, multitenant technology and service technology.
3. Illustrate DevOps workflow in script creation and source control
4. Describe data storage options and design to survive failures

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Compare the cloud computing service models, deployment models and its applicability in virtualized environments	1 to 4, 8, 9 , 12	1
CO2	Make use of the cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology and service technology.	1 to 3, 5,9,12	1
CO3	Demonstrate the DevOps workflow in script creation, troubleshooting and error handling	1 to 5, 9, 12	3
CO4	Analyze the data storage options to overcome survive failures	1,4,5,9,12	1
CO5	Illustrate the basic services provided by Azure cloud.	1 to 5	1
CO6	Apply source control mechanism to develop real world applications.	1 to 5	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	1	1	2	2				1	1			1	3		
CO2	3	2	3		2				1			1	3		
CO3	3	1	2	1	2				1			1			3
CO4	3			2	2				1			1	3		
CO5	3	2	2	1	3								3		
CO6	2	2	3	2	2								3	3	

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Cloud Characteristics, Cloud Delivery Models and Cloud Deployment Models.

Virtualization: Implementation levels of virtualization, virtualization structures/tools and mechanisms, virtualization of CPU, memory and I/O devices.

UNIT – 2

Cloud Enabling 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

Automate everything, DevOps workflow: Azure management scripts, Environment creation script, Parameters in the main script, Create the website , Create the storage account, Create the databases Store app settings and connection strings, Troubleshooting and error handling, Deployment script

Source control: Treat automation scripts as source code, Structure source branches to facilitate DevOps workflow, Add scripts to source control in Visual Studio, Store sensitive data in Azure

UNIT – 4

Data storage options: Data storage options on Azure, Hadoop and MapReduce Platform as a Service (PaaS) versus Infrastructure as a Service (IaaS), Choosing a data storage option, Demo: Using SQL Database in Azure

Design to survive failures: Types of failures, Failure scope, Machine failures, Service failures, Region failures, SLAs, Composite SLAs, Cloud SLAs compared with enterprise downtime experience

TEXT BOOKS:

1. Thomas Erl , Ricardo Puttini , Zaigham Mahmood ,"Cloud Computing: Concepts, Technology & Architecture ",PHI, 20l3.
2. Mark Simms, Scott Guthrie, and Tom Dykstra, "Building Cloud Apps with Microsoft Azure: Best Practices for DevOps, Data Sorage, High Availability and more", Published by Microsoft Press, 2014.(Chapter 1, 2, 6 and 9)

REFERENCE BOOKS:

1. SunilkumarManvi, Gopal K. Shyam, "Cloud Computing: Concepts and Technologies", First edition, CRC press, 2021.
2. Dan C. Marinescu, "Cloud Computing: Theory and Practice," MK
3. RajkumarBuyya, JamesBroberg, Andrzej Goscinski," Cloud Computing- Principles and Pradigms", Wiley.
4. Gautam Shroff, "Enterprise Cloud Computing- Technology, Architecture, Applications", CAMBRIDGE.
5. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra", Distributed and Cloud Computing",MK,20l2
6. Michael Collier, Robin Shahan, "Fundamentals of Azure-Microsoft Azure Essentials", Microsoft Press, 2nd Edition,20l6.
7. Neil Peterson, "Get started guide for Azure IT operators", Microsoft,20l6.
8. Roberto Brunetti, "Windows Azure-Step by Step", Oreilly Media,20ll.

JOURNALS/MAGAZINES:

1. Journal of Cloud Computing -Advances, Systems and Applications, Springer Open.
2. International Journal of Cloud Computing, INDERSCIENCE Publishers.
3. IEEE Transactions on Cloud Computing, IEEE.
4. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Introduction to Cloud computing
2. https://www.udemy.com/course/introduction-cloud-computing/
3. https://nptel.ac.in/courses/106/105/106105223/
4. https://www.edx.org/learn/Cloud-computing-Infrastructure

SELF-LEARNINGEXERCISES:

1. Creating a private cloud using Open Stack.
2. Give a report on benefit of Cloud on Health Industry.
3. Give a report on benefit of Cloud for Farmers.
4. Execute some of the Azure based projects available in Github.
5. Write a note on Azure virtual machines.
6. Develop applications using Open source Cloud computing tools like OpenNebula and Eucalyptus
7. What are reasons that make Amazon so big?
8. Explain the security usage in the Amazon Web Services model.
9. Explain how you can vertically scale an Amazon instance. Mention the key components of AWS. Explain security management in terms of Cloud Computing.
10. Compare the three cloud computing delivery models, SaaS, PaaS, and IaaS, from the point of view of the application developers and users. Discuss the security and the reliability of each one of them. Analyze the differences between the PaaS and the IaaS.
11. Overprovisioning is the reliance on extra capacity to satisfy the needs of a large community of users when the average-to-peak resource demand ratio is very high. Give an example of a large-scale system using overprovisioning and discuss if overprovisioning is sustainable in that case and what are the limitations of it. Is cloud elasticity based on overprovisioning sustainable? Give the arguments to support your answer.
12. An organization debating whether to install a private cloud or to use a public cloud, e.g., the AWS, for its computational and storage needs, asks your advice. What information will you require to base your recommendation on, and how will you use each one of the following items: (a) the description of the algorithms and the type of the applications the organization will run; (b) the system software used by these applications; (c) the resources needed by each application; (d) the size of the user population; (e) the relative experience of the user population; (d) the costs involved.

Course Title	**Advanced Machine Learning**	**Course type**	**Theory-SC**

Course Code	B20EFS618	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	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	3	3	3	39	-	50	50

COURSE OVERVIEW:

The Advanced Machine learning course gives an awareness of advanced algorithms that can be used to crack the frontier problems of the current day. The machine learning techniques covered in this course are at the forefront of commercial practice. They are applicable in image recognition, NLP and web search, Computational creativity, and commercial/financial data modeling. Deep Learning algorithms and ensembles of models are in use by data scientists at top tech and digital companies and this course updates the skills needed to apply them successfully. This course is designed to understand the relevant and powerful machine learning techniques, semi-supervised learning and more, in real world applications.

COURSE OBJECTIVE (S):

The Objectives of this course are to:

1. Explaining different Unsupervised Learning methods used to build the models.
2. Identify the RBM, DBN and CNN Neural networks.
3. Discuss how to improve performance by reviewing model output using Ensemble Methods.
4. Describe the Text Engineering methods to improve the learnability of features to build effective models.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of unsupervised learning techniques to identify patterns and structure within datasets	1 to 5	1
CO2	Analyze the performance against meaningful targets using RBM and DBN algorithms.	1 to 5	2
CO3	Identify suitable Ensemble methods to solve the given real world problems.	1 to 5	2,3
CO4	Develop Feature engineering techniques that significantly increase the effectiveness of the models.	1 to 5	2,3
CO5	Apply convolutional neural networks concepts in real world application.	1 to 5	1
CO6	Analyze different text feature engineering mechanism to solve the given real world problems.	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	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	3	2	2	1	2								3		
CO6	2	2	1	3	2								3	3	

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

COURSE CONTENT

THEORY:

Unit-1

Unsupervised Machine Learning: Principal component analysis, PCA – a primer, Employing PCA, Introducing k-means clustering, Clustering – a primer, Kick-starting clustering analysis, Tuning your clustering configurations, Self-organizing maps, SOM – a primer, Employing SOM.

Unit-2

Deep BeliefNetworks: Neural networks – a primer, The composition of a neural network, Network topologies, Restricted Boltzmann Machine, Introducing the RBM, Topology, Training, Applications of the RBM, Further applications of the RBM, Deep belief networks, Training a DBN, Applying the DBN, Validating the DBN.

Convolutional Neural Networks, Introducing the CNN, Understanding the convent topology, Understanding convolution layers, Understanding pooling layers, Training a convent, Putting it all together, Applying a CNN.

Unit-3

Semi-Supervised Learning: Introduction, Understanding semi-supervised learning, Semi-supervised algorithms in action, Self-training, Implementing self-training, Finessing your self-training implementation, Contrastive Pessimistic Likelihood Estimation.

Ensemble Methods: Introducing ensembles, Understanding averaging ensembles, Using bagging algorithms, Using random forests, Applying boosting methods, Using XGBoost, Using stacking ensembles, Applying ensembles in practice, Using models in dynamic applications, Understanding model robustness, Identifying modelling risk factors, Strategies to managing model robustness.

Unit-4

Text Feature Engineering: Introduction, Text feature engineering, Cleaning text data, Text cleaning with BeautifulSoup, Managing punctuation and tokenizing, Tagging and categorising words, Creating features from text data, Stemming, Bagging and random forests, Testing our prepared data.

TEXT BOOKS:

1. John Hearty, "Advanced Machine Learning", Packt Publishing, 2016.

REFERENCE BOOKS:

1. Kevin P. Murphy." Machine Learning: A Probabilistic Perspective", MIT Press 2012
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", Press 2016
3. YaovGoldberg,"A Primer on neural networks for natural language processing",2016
4. Michael Nilso, "Neural Networks and Deep Learning", 2015.
5. https://www.researchgate.net/publication/267453303

JOURNALS/MAGAZINES:

1 IEEE Transactions on Pattern Analysis and Machine Intelligence.
2 Springer Journal of Machine Learning.
3 Elsevier Journal of Machine Learning with Applications.

SWAYAM/NPTEL/MOOCS:

1. https://www.udemy.com/deeplearning/
2. https://www.coursera.org/learn/deep-learning
3. https://nptel.ac.in/courses/deeplearning/

SELF-LEARNING COMPONENT:

1. Lasagne Tool, Tensorflow.

Course Title	Research Based Mini Project				Course Type		HC	
Course Code	B20EF0603	Credits	2		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	2	4	4	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**4**	**4**	**0**	**26**	**50**	**50**

COURSE OVERVIEW

The research based mini project is focused at providing the platform for students to enhance their research aptitude and develop the skills they require for developing the trending applications using the latest technologies. Additionally, this course gives a platform to students to showcase their talent by doing innovative projects that strengthen their profile making themselves employable in various domains.

COURSE OBJECTIVE (S):

1. To create an Industrial environment and culture within thedepartment of CSE.
2. To provide students hands on experience on, troubleshooting, maintenance,innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education.
3. To promote the concept of entrepreneurship.
4. To inculcate innovative thinking and thereby preparing students for main project.

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic.	7 to 12	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project workto attain substantiated conclusions.	7 to 12	1,2,3
CO3	Design solutions to the chosen project problem.	7 to 12	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	7 to 12	1,2,3
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work.	7 to 12	1,2,3
CO6	Apply project results for sustainable development of the society.	7 to 12	1,2,3

CO7	Understand the impact of project results in the context of environmental sustainability.	7 to 12	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	7 to 12	1,2,3
CO9	Function effectively as individual and a member in the project team.	7 to 12	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	7 to 12	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	7 to 12	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	7 to 12	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			√	√	√	
CO7			√	√	√	
CO8			√	√	√	
CO9			√	√	√	
CO10			√	√	√	
CO11			√	√	√	
CO12			√	√	√	

COURSE ARTICULATIONMATRIX

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

CO2							3	3	3	3	3	3	3	3	3
CO3							3	3	3	3	3	3	3	3	3
CO4							3	3	3	3	3	3	3	3	3
CO5							3	3	3	3	3	3	3	3	3
CO6							3	3	3	3	3	3	3	3	3
CO7							3	3	3	3	3	3	3	3	3
CO8							3	3	3	3	3	3	3	3	3
CO9							3	3	3	3	3	3	3	3	3
CO10							3	3	3	3	3	3	3	3	3
CO11							3	3	3	3	3	3	3	3	3
CO12							3	3	3	3	3	3	3	3	3

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

The following are the guidelines to be followed by the students to complete their research based mini projects.

1. The students shall form groups (max 4) and select their guides based on their area of interest in their previous semester.
2. In the beginning of the current semester the students shall corner the problem by performing the literature survey (by choosing the research papers of reputed Journals) in their area of interest.
3. The students shall choose a base paper from the list of papers they would have surveyed.
4. The students shall identify the research gaps in their selected research domain, and finalize their problem statement with objectives for the research based mini project.
5. The students shall be completing the synopsis presentation (phase-1 presentation (progress)), and phase-2 presentation (implementation with demo) as per the calendar set by the concerned coordinator.
6. Finally, the students shall complete their mini projects providing innovative solutions for the selected research problem and apply for patent / copyright / paper publication in SCOPUS indexed journals / research proposals / product development / and or startups.

CourseTitle	Mobile Application Development				CourseType	Theory	
CourseCode	B20EF0604	Credits	1		Class	VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	TotalNumber of ClassesPer Semester	Assessment in Weightage	
	Theory	1	1	1			
	Practice	0	0	0	Theory	CIE	SEE
	-	-	-	-			
	Total	1	1	1	**13**	**50**	**50**

COURSE OVERVIEW

This course is concerned with the development of applications on mobile and wireless computing platforms. Android will be used as a basis for teaching programming techniques and design patterns related to the development of standalone applications and mobile portals to enterprise and commerce systems. Emphasis is placed on the processes, tools and frameworks required to develop applications for current and emerging mobile computing devices. Students will work at all stages of the software development life-cycle from inception through to implementation and testing. In doing so, students will be required to consider the impact of user characteristics, device capabilities, networking infrastructure and deployment environment, in order to develop software capable of meeting the requirements of stakeholders.

COURSE OBJECTIVE (S):

1. Explain the android SDK.
2. Illustrate about the basic understanding of Android application development
3. Demonstrate the use of knowledge of Android Studio development tool.

COURSEOUTCOMES(COs)

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

CO#	CourseOutcomes	POs	PSOs
CO-1	Understand the concepts of mobile programming that make it unique from programming for other platforms.	1,2,3,4, 5,11,12	1,2,3
CO-2	Identify the mobile applications on their design pros and cons.	1,2,3,4, 5,11,12	1,2,3
CO-3	Evaluate the rapid prototyping techniques to design and develop sophisticated mobile interfaces.	1,2,3,4,5,1 1,12	1,2,3
CO-4	Solve the Program mobile applications for the Android operating system that use basic and advanced phone features.	1,2,3,4, 5,11,12	1,2,3
CO-5	Determine the Android marketplace for distribution.	1,2,3,4, 5,11,12	1,2,3
CO-6	Analysis working with different types of resources.	1,2,3,4, 5,11,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO-1		√				
CO-2			√			
CO-3					√	
CO-4			√			
CO-5					√	
CO-6			√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3	3	3	3						3	3	3	3	3
CO-2	3	3	3	3	3						3	3	3	3	3
CO-3	3	2	3	3	3						3	3	3	3	3
CO-4	3	3	3	3	3						3	3	3	3	3
CO-5	3	3	3	3	3						3	3	3	3	3
CO-6	3	2	3	3	3						3	3	3	3	3

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

COURSE CONTENT

THEORY:

UNIT - 1

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT - 2

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT - 3

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT- 4

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
2. Dawn Griffiths, "Headfirst Android Development", O'Reilly, 1st ed.

REFERENCE BOOKS:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

JOURNALS/MAGAZINE:

https://ieeexplore.ieee.org/document/6104696

SWAYAM/NPTEL/MOOCs:

1.https://nptel.ac.in/courses/106106156

2. https://onlinecourses.nptel.ac.in/noc20_cs52/preview

3. https://www.coursera.org/learn/aadcapstone

4.https://onlinecourses.swayam2.ac.in/nou21_ge41/preview

SELF-LEARNINGEXERCISES:

1. Android Development

Course Title	Big Data and Cloud Computing lab	Course Type	HC

Course Code	B20EF0605	Credits	1		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**26**	**25**	**25**

COURSE OVERVIEW:

This course provides students with the foundation of Big Data and distributed computing systems and applications especially in context of Cloud. In addition, the course equips students with essential knowledge required to build next-generation applications that are scalable and efficient.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Demonstrate the knowledge of big data analytics in handling data.
2. Understand and implement the concept of database connectivity to Pyspark.
3. Import csv dataset to Spark framework and perform big data analysis.
4. Work on a project that mimics real world situations.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply PySpark practices on data using RDD and data frame.	1 to 5,8,9,10,12	1,2,3
CO2	Execute Apache and spark for database connectivity	1 to 5,8,9,10,12	1,2,3
CO3	Implement the Big data analysis in interactive session of Spark.	1 to 5,8,9,10,12	1,2,3
CO4	Execute union, intersection, and transformation operation on different data in python	1 to 5,8,9,10,12	1,2,3
CO5	Analyze user information from Movie Lens data set using python	1 to 5,8,9,10,12	1,2,3
CO6	Create a mini project that mimics real world situations	1 to 5,8,9,10,11,12	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	2	2	2	2			1	2	2		2	3	2	2
CO2	3	2	2	2	2			1	2	2		2	3	2	2
CO3	3	2	2	2	2			1	2	2		2	3	2	2
CO4	3	2	2	2	2			1	2	2		2	3	2	2
CO5	3	2	2	2	2			1	2	2		2	3	2	2
CO6	3	3	3	3	3			2	3	3	2	3	3	3	3

No.	List of Experiment	Tools and Techniques	Expected Skill /Ability

	Part-A:(Implantation of Basic Concepts of Spark using Python Programming)		
1	Write an interactive code in Python to read any text file into a RDD (dataset), and then perform the following operations in an interactive session of Spark. a) Display the contents of an RDD using collect() b) To return the first element from the RDD c) To return the first n lines from the RDD and display them on the console. d) To return n random elements from the dataset, with or without replacement (true or false). Use seed as an optional parameter for a random generator. To count the number of lines in the RDD.	PySpark	Python Programming language
2	Demonstrate how the Apache Spark can load data into any RDBMS that supports JDBC connectivity like Postgres and MySQL., by performing the following operations. a) Create a table in MySQL and insert some arbitrary data into it. b) Create a SqlContext of PySpark to connect to MySQL and load the table as a data frame. c) Create a SqlContext of PySpark to perform a simple operation using the world database (you can download the world database from http://downloads.mysql.com/docs/world.sql.zip). World database can be imported into MySQL using the name world. d) Load the two popular tables-Country and Country Language into the spark shell. Find out the language corresponding to each by combining the two tables with a common key Code.	Apache MySQL PySpark	Python Programming language
3	Write an interactive code in Python to read any text file into a RDD (dataset), and then perform the following operations in an interactive session of Spark. a) Using map() function, divide each string on spaces and analyze the structure of RDD created from *.txt file. b) Demonstrate how flatMap() is different from Map transformations on RDD. c) Using filter() function, find the count of lines having some term “x” in the RDD. d) Using filter() function, find the count of lines committed with the text of the form “*@*.com” in the RDD. Using replacement() and collect() functions, sample the 50% of the lines of RDD created from *.txt file.	PySpark	Python Programming language
4	Write an interactive code in Python to read the marks of any two students, perform union operation to combine their overall marks, and to combine the marks of any two students based on each subject.	MySQL	Python Programming language

5	Write an interactive code in Python to find the common terms or objects from the two RDDS using intersection() transformation function, and to pick out the lines from the RDD that are unique using distinct() transformation function.	MySQL	Python Programming language
6	Write an interactive code (or launch an application) in Python to analyze the following demographic information about the users from the MovieLens data set (https://grouplens.org/datasets/movielens/). a) Load the data into a spark RDD b) Count the number of users c) Create a user defined function to divide the users into age groups d) Analyze age group "20-30" for further analysis e) Count the number of users by their profession in the given age_group 20-30. f) Count the number of movie users in the same age group based on gender. g) Use Accumulators for outlier detection in the above movie dataset. Check how many users are under age and how many are over aged.	PySpark MySQL	Python Programming language
7	Write an interactive code in Python to create a SparkContext and then use it to create a DataFrame through the following. a) Create the list of tuple with some information b) Build a RDD using the tuples created c) Convert the tuples using map() d) Create a DataFrame context using the converted tuples. Find the type of each feature in the DataFrame using printSchema()	PySpark	Python Programming language
	Part-B:(Live Mini Project Implementation using Spark Framework) – 4 Weeks		
8	Implement the following steps to build a Machine Learning Model on any of the CSV data downloaded from the Internet with PySpark: a) Basic operations with PySpark. b) Data preprocessing. c) Build a data processing pipeline. d) Build the classifier. (Ex. Logistic Regression). e) Train and evaluate the model.	PySpark	Python Programming language

	Tune the hyper-parameters of the model.		

TEXT BOOKS

1. Hwang, Kai, and Min Chen. Big-data analytics for cloud, IoT and cognitive computing. John Wiley & Sons, 2017.
2. Aven, Jeffrey. Data Analytics with Spark Using Python. Addison-Wesley Professional, 2018.

Course Title	**Mobile Application Development Lab**				**Course Type**	**HC**
Course Code	**B20EF0606**	**Credits**	**1**		**Lab**	**VI Semester**
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes	Assessment in

Course Structure	Theory	-	-	-	Per Semester		Weightage	
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**26**	**25**	**25**

COURSE OVERVIEW:

The Android Laboratory is a 26-hours module within the Course on Mobile Application Laboratory, for the undergraduate students of REVA University . The goal of this module is to introduce the basics of mobile applicationsdevelopment for Android-based terminals . we aim at presentingthe essential concepts of APP development and deployments for mobile and battery-constrained devices, at introducing the main characteristics and components of the Android projects, and at providing the minimum know-how required to develop (from scratch) mobile applications for the Android architecture, at increasing levels of complexity.

COURSE OBJECTIVE (S):

1. Creating robust mobile applications and learn how to integrate them with other services.
2. Creating intuitive, reliable mobile apps using the android services and components.
3. Demonstrate the use of knowledge of Android Studio development tool.
4. Creating intuitive, reliable mobile apps using the android services and components.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	CourseOutcomes	POs	PSOs
CO-1	Build enterprise level mobile applications with Android	1,2,3,4,5,6,9,11,12	1,2,3
CO-2	Understand both the basic and advanced concepts of Android.	1,2,3,4,5,6,9,11,12	1,2,3
CO-3	Understand why use Android over Java.	1,2,3,4,5,6,9,11,12	1,2,3
CO-4	Install and configure Android Studio.	1,2,3,4,5,6,9,11,12	1,2,3
CO-5	Explain and use key Android programming concepts.	1,2,3,4,5,6,9,11,12	1,2,3
CO-6	Deploy the App application in different devices.	1,2,3,4,5,6,9,11,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)

CO-1		√				
CO-2			√			
CO-3					√	
CO-4			√			
CO-5					√	
CO-6			√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3	3	3	3	3			3		3	3	3	3	3
CO-2	3	3	3	3	3	3			3		3	3	3	3	3
CO-3	3	2	3	3	3	3			3		3	3	3	3	3
CO-4	3	3	3	3	3	3			3		3	3	3	3	3
CO-5	3	3	3	3	3	3			3		3	3	3	3	3
CO-6	3	2	3	3	3	3			3		3	3	3	3	3

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	Development Of Android APP used for agriculture and It must provide fertile agriculture content and information at every stage of the crop life cycle.	Android Studio	Java Programming Language
2.	Create a diagnostic appto book for the doctorappointmentand lab test reports bythe patient.	Android Studio	Java Programming Language
3.	Create an android application to develop an employee management system.	Android Studio	Java Programming Language
4.	Design an Fingerprint voting system using android application by displaying all the nominated candidates.	Android Studio	Java Programming Language
5	Mini Project	Android Studio	Java Programming Language

TEXT BOOKS:

1. Wei-Meng Lee," Beginning Android Application Development" , 1st Ed, Wiley Publishing
2.J. F. DiMarzio, "Android: A Programmers Guide", McGraw Hill Education (India) Private Limited.1st Edition

REFERENCE BOOKS:

1. Paul Deitel "Android for Programmers: An App-Driven Approach" 1st Edition, Pearson India.
2. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India Pvt Ltd

JOURNALS/MAGAZINE:

https://ieeexplore.ieee.org/document/6104696

SWAYAM/NPTEL/MOOCs:

1.https://nptel.ac.in/courses/106106156

2. https://onlinecourses.nptel.ac.in/noc20_cs52/preview

3. https://www.coursera.org/learn/aadcapstone

4.https://onlinecourses.swayam2.ac.in/nou21_ge41/preview

SELF-LEARNINGEXERCISES:

3. Android Development

CourseTitle	Technical Documentation				CourseType		FC	
CourseCode	B20EF0607	Credits	1		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	TotalNumber of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	IA	SEE
	-	-	-	-				
	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 (S):

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)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	CourseOutcomes	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 stylesand collaborative writing.	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	Identify the importance of editing and edit without bias	1,4,5,9,12	1
CO5	Apply the techniques of technical writing for Thesis, project proposal, and paper	1 to 5	1,3
CO6	Analyse document, and report clearly, concisely, logically, and ethically	1 to 5	2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#/ POs	Bloom'sLevel					
	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
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	1	2	1	2	3							2		3
CO6	1	2	1	2	3								2	3

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

COURSE CONTENT

THEORY:

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" ,NewDelhi:Vistaar Publications, 2004.

2. F. Mittelbach and M. Goossens, "The LATEX Companion", 2nd. ed. Addison Wesley, 2004

Course Title	Skill development-2			Course Type	HC
Course Code	B20EF0608	Credits	2	Class	VISemester

Course Structure	TLP	Credits	Contact Hours	Work LoadLoa	Total Number of Classes Per Semester	Assessment in Weightage	
	Theory	2	4	-			
	Practice	-	-	-	Theory	CIE	SEE
	Tutorial	**-**	**-**	**-**			
	Total	**2**	**4**	**-**	-	-	-

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	1,2,3

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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Skill development-2:

Students will be offered training and certifications on the trending technologies from the industry experts.

The students are evaluated and certified after the training programs.

Open Elective-II:

Course Title	Data Structures	Course Type	Theory

Course Code	B20CSO601	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:

This course covers basic data structures techniques and their implementation in Java. Familiarize the concept of Abstract Data Types (ADT), stacks, Queues and Trees. The course also introduces applications of these data structures in solving problems. Students are expected to use these data structure concepts to write simple programs.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain the basic Concepts of java and Data Structures

2. Illustrate the creation and use of singly and doubly Linked list in Java.

3. Demonstrate the use of Stacks and Queues in real world applications.

4. Discuss the concept and applications of Binary trees.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Java Arrays to solve real world problems.	1 to 5	1
CO2	Develop a java program for implementing the linked list.	1 to 5	1,2
CO3	Build a realworld application in Java using stacks and queues.	1 to 5	1,2
CO4	Apply the concepts of trees for solving real world problems.	1 to 5	1,2
CO5	Identify the most suitable data structure for real world application.	1 to 5	1,2,3
CO6	Experiment with all data structures in a high-level language for problem solving.	1 to 5	1,2,3

BLOOM'S LEVELOF THECOURSE 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	3	2	2	3	2								3		
CO2	3	2	3	3	2								3	3	
CO3	3	1	2	3	1								3	3	
CO4	3	1	3	3	2								3	3	
CO5	3	3	3	3	1								3	3	3
CO6	3	3	3	3	2								3	3	3

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Data Structures: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms; Arrays-Sorting an Array (Insertion Sort), java.util Methods for Arrays, Cryptography with character arrays; Two-dimensional Arrays and positional games.

UNIT – 2

Linked list: Singly Linked List, Implementing a Singly linked list class; Circularly Linked List, Round-Robin Scheduling, Designing and implementing a circularly linked list; Doublylinked List, Implementing a Doubly linked list class.

UNIT – 3

Stacks: Introduction, The Stack Abstract Data type, A Simple Array-based Stack implementation, Implementing a Stack with a Singly Linked List.

Queue: Introduction, The Queue Abstract Data type, Array-based Queue implementation, implementing a Queue with a Singly Linked List.

UNIT – 4

Trees: General Trees-Tree definitions and properties, The Tree Abstract data type, computing depth and height; Binary Trees: The Binary Tree abstract data type, properties of Binary Trees; Implementing Trees- Linked structure for Binary Trees; Tree Traversal Algorithms- Preorder, Postorder Traversals of General Tree, Inorder Traversal of a Binary Tree, Implementing Tree Traversal.

TEXTBOOKS:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in JAVA ", Wiley, 6th Edition, 20l4
2. Herbert Schildt, "The Complete reference Java", 7th edition, 2007

REFERENCEBOOKS:

1. Richard Gilberg, Behrouz Forouzan, "DataStructures: A Pseudocode Approach with C", Cengage Learning,2004.
2. DebasisSamanta, "Classic DataStructures", second edition, PHI Learning Private Limited,2011.

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 Department 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-LEARNINGEXERCISES:

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 traversal

4th Year Syllabus

VII SEMESTER

Course Title	Virtual and Augmented Reality				Course Type		Theory-SC	
Course Code	B20EFS711	Credits	3		Class		VII 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:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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	Make use of unity3D to develop innovative project.	1 to 3, 10	2,3
CO6	Apply VR modeling techniques to solve real world applications.	1,2,10	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			3		
CO2	3	3	3		3					3					3
CO3	3	3	3							3				3	3
CO4	3									3			3		
CO5	3	2	2							3				3	3
CO6	3	2								2			3	3	

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.

TEXTBOOKS:

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.

REFERENCEBOOKS:

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:

1. Unity 3D, Manus VR

Course Title	User Interface(UI)/ User Experience (UX) Design				Course Type		Theory-SC	
Course Code	B20EFS712	Credits	3		Class		VII 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:

This course is designed to give a foundational understanding of how people interact with computers and computing technologyand will provide with a set of basic skills for evaluating and designing for this type of interaction. These are valuable skills to have, especially if a student is considering post-baccalaureate work in the fields of psychology, design, computer science, or plan to work in industry with such technology. Even if a student does not plan to pursue a career in such areas, this is useful information to know to improve his/her own interaction with technology.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Explain user interface design process for a given problem

2: Illustrate the selection of designs, utilize the design thinking processes with UX/UI tools.

3: Describe the assumptions and prototype potential design solutions.

4: Discuss the issues and challenges to achieving a human-centered design process, especially with regard to user experience design

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSO
CO1	Identify the new technologies to design user interfaces for the given realworld application	1 to 5,7, 9, 12	1
CO2	Make use of the UI/UX design process to develop the given real world application.	1 to 5,9,12	1
CO3	Develop applications using various Interaction styles including Direct Manipulation and Virtual Environment.	1 to 5,9,12	2,3
CO4	Apply structure plane to develop web and mobile UI/UX based applications.	1 to 5,9,12	2,3
CO5	Design a conceptual framework that breaks down the user experience problems into different planes for ensuring better product.	1 to 5,9,12	1
CO6	Make use of users functional requirements to solve real world applications.	1 to 5,9,12	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#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1		1			2	3		
CO2	3	2	2	2	2				1			1	3		
CO3	3	2	2	2	2				1			1		3	3
CO4	3	2	2	2	2				1			1		3	3
CO5	3	2	2	3	2				1			1	3		
CO6	2	2	3	2	2				2			1	3	3	

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

COURSE CONTENT

THEORY:

UNIT – 1

A Design Process for Digital Products-The consequences of poor product behaviour, why digital products fail, Planning and designing product Behavior, Recognizing user goals, Implementation model and mental models; **Modeling Users: Personas and Goals -**Why Model, The power of personas, Why people are effective, Understanding Goals, Constructing Personas, Personas in practice, Other design models.

UNIT – 2

Setting the Vision: Scenarios and Design Requirements – Bridging the research-design gap, Scenarios- Narrative as a design tool, Design requirements : The "What" of interaction, The requirements definition process; **Designing the Product: Framework and Refinement –** Creating the Design framework, Refining the form and

Behavior, validating and testing the design; **A Basis for Good Product Behavior-** Design values, Interaction design principles , Interaction design patterns

UNIT – 3

User Experience and Why It Matters? Everyday Miseries, Introducing user experience, From product design to user experience design; **Meet the Elements –** The five planes, a basic duality, Building from bottom to top, The elements of user experience; **Understanding the Strategy Plane** – Defining strategy, Product Objectives and user needs, Team roles and process; **Understanding the Scope Plane –** Defining the scope, functionality and content, defining requirements, functional specifications, content requirements and prioritizing requirements**.**

UNIT – 4

Understanding the Structure Plane-Defining the Structure, Interaction design, Information Architecture, Team roles and process; **Understanding the Skeleton Plane-** Defining the skeleton, convention and metaphor, Interface design, Navigation design, Information design, Wireframes; **Understanding the Surface Plane –** Defining the surface, Making sense of the senses, Follow the Eye, Contrast and uniformity, Internal and external consistency, Color Palettes and Typography, Design Comps and Style Guides; **UI/UX Designing for the Desktop, Mobile and other devices. UI/UX Designing for the web.**

TEXTBOOKS:

1.Alan Cooper, “About Face-Essential of the User Interface Design”, Wiley, 4th edition, 2014

2.Jenifer Tidwell, “Designing Interfaces”, O'Reilly Media, 2nd edition, 2010.

REFERENCEBOOKS:

1.William Buxton, “Sketching user experiences-getting the design right and the right design”, Elsevier-Morgan Kaufmann, 2007.

2.Don Norman, “The Design of Everyday Things “, Revised and Expanded Edition, 2013.

3.Jesse James Garrett,”The Elements of User Experience-User-Centred Design for the Web and Beyond”, 2nd Edition, New Riders Press, 2010.

JOURNALS/MAGAZINES:

1. ACM, International Journal of Human-Computer Studies.
2. IEEE, Transactions on Human-Machine Systems.
3. Elsevier, International Journal of Human-Computer Studies.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in
2. https://www.edx.org
3. https://www.coursera.org/specializations/user-interface-design

4. https://www.udemy.com/topic/user-interface/
5. https://www.skillshare.com/browse/ui-design

SELF-LEARNINGEXERCISES:

1. Implementation of Common sight patterns in the Interaction design
2. Prediction of User expectations
3. Choosing and using the best UI patterns.

Course Title	Data Science Using R				Course Type		Theory-SC	
Course Code	B20EFS713	Credits	3		Class		VII 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:

R is rapidly becoming the leading language in data science and statistics. R is the tool of choice for data science professionals in every industry and field. Whether the person is full-time number cruncher, or just the occasional data analyst, R will suit their needs. Predictive analysis will help in creating predictive models to solve real life problems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Discuss the basics of R programming.

2.Demonstrate the use of Control Structures, Functions.

3.Illustrate the use of features of Graphics package in real world applications.

4.Describe the different models with respect to predictive analysis.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Control structures and functions for real world applications.	1 to 5	1
CO2	Apply the R graphics features for the given real world application	1 to 5	2,3
CO3	Solve real world problem using Regression Models.	1 to 5	2
CO4	Develop Classification model for the given real-world problem.	1 to 5	2,3
CO5	Identify the basic concepts of R Programming language.	1 to 5	1
CO6	Make use of predictive analysis to solve real world applications.	1 to 5	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#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3								3		
CO2	3	2	3	1	3									3	3
CO3	3	2	3	1	3									3	
CO4	3	2	3	1	3									3	3
CO5	3	2	3	1	3								3		
CO6	3	2	2	1	2								3	3	

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

COURSE CONTENT

THEORY:

UNIT – 1

History and overview of R: R nuts and bolts, Getting Data In and Out of R, Interfaces to the Outside World, Sub setting R Objects.Managing Data Frames with the dplyr package, Control Structures, Functions, Loop functions

UNIT – 2

R Graphics: Quickly exploring data, Bar graphs: Making a Basic Bar Graph, Grouping Bars Together, Making a Bar Graph of Counts, Using Colors in a Bar Graph, Line graphs: Making a Basic Line Graph, Adding Points to a Line Graph, Making a Line Graph with Multiple Lines, Changing the Appearance of Lines, Changing the Appearance of Points, Making a Graph with a Shaded Area, Scatter plots: Making a Basic Scatter Plot, Grouping Data Points by

a Variable Using Shape or Color, Using Different Point Shapes, Mapping a Continuous Variable to Color or Size, Dealing with Over plotting.

UNIT – 3

Predictive analysis: Data preprocessing, Regression Models: Measuring performance in regression models, Linear Regression and its cousins: Linear regression, Nonlinear Regression Models: Neural networks.

UNIT – 4

Classification Models: Measuring Performance in Classification Modelling: class prediction, Evaluating predicted class, evaluating class probabilities. Discriminant Analysis and Other Linear Classification Models, Logistic Regression, Linear Discriminant Analysis, Nonlinear Classification Models: Nonlinear Discriminant Analysis, Neural Networks, Flexible Discriminant Analysis, Support Vector Machines, K-Nearest Neighbors, Na¨ıve Bayes, Computing.

TEXTBOOKS:

1.Roger D. Peng, “R Programming for Data Science”, Leanpub, 2015

2.Winston Chang, “R Graphics Cookbook Practical Recipes for Visualizing Data”, O'Reilly Media, 2012

3.Kuhn, Max, Johnson and Kjell, “Applied Predictive Modeling”, Springer eBook.

REFERENCEBOOKS:

1.John Maindonald, W. John Braun, “Data Analysis and Graphics Using R - an Example BasedApproach”, 3rd Edition, Cambridge University Press, 2010. (Unit 1 & 2)

2.Johannes Ledolter, “DATA MINING AND BUSINESS ANALYTICS WITH R”, WILEY, 2013. (Unit3)

3.W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, Notes on R: A Programming Environment for Data Analysis and Graphics Version 3.2.4 (2016-03-10) (Unit 4)

4.Springer, International Journal of Data Science and Analytics.

5.Elsevier, Computational Statistics & Data Analysis

6.IEEE, Transactions on Big Data.

JOURNALS/MAGAZINES:

1. https://www.springer.com/journal/41060
2. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
3. https://blog.usejournal.com/python-vs-and-r-for-data-science-833b48ccc91d

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/course/r-programming

2. https://nptel.ac.in/courses/106/106/106106182/
3. https://www.edx.org
4. https://www.coursera.org/learn/r-programming

SELF-LEARNINGEXERCISES:

1. Creating own datasets.
2. Functions and packages in R and using packages in R.
3. Executing linear model for example data set.
4. Creating Neural Networks for example data set.

Course Title	Capstone-Project Phase-1				Course Type		HC	
Course Code	B20EF0701	Credits	1		Class		VII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**0**	**26**	**50**	**50**

COURSE OVERVIEW

The major project is a two semester-long practical project with the main objective that students show their ability to apply theoretical concepts learned in lectures to solve (complex) practical problems. The results are to be presented in a project report and as an oral presentation.

The major project must be completed as a team project. Team projects are limited to a minimum of two students to a maximum number of four students.

COURSE OBJECTIVE (S):

1. To allow students to demonstrate a wide range of the skills learned during theircourse of study by asking them to deliver a product that has passed through the design, analysis, testing andevaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3

CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Capstone-Project Phase-1:

- Student should carry out project work in a group which is formed in the VII semester. Student must select group members from the same section as they belong to and select a faculty member from department of CSE as aninternal project guide based on research domain and expertise. Student may optionally also select external guide bearing domain expertise from different departments within University and Industry to carry out multidisciplinary project.
- Student group must propose a project title, after consultation with guides and after carrying out a literature survey. The proposed title must be submitted in form a document (synopsis) that contains the proposed title of the project, an abstract, Introduction, Survey, Feasibility, and cost estimation to carry out the project.
- Further with the help of respective guide, each student group have to the literature review based on the literature survey, identify the research gaps in the selected research/project domain, and then finalize the problem statement and objectives for the project.
- Each student groups shall be reviewed and evaluated in two reviews through the semester.

- Review 1 shall be on the presentation of the synopsis and justification of the title and feasibility of the project
- Review 2 shall be on the presentation on the literature survey carried out.

Finally, the Capstone-Project Phase-1 shall conclude with each project group apply for idea patent or copyright and publish a survey paper in SCOPUS indexed journals, write research proposals for fundings from various governmental organizations or industries

Course Title	Internship/Global Certification				Course Type		HC	
Course Code	B20EF0702	Credits	3		Class		VII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	3	6	6	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**6**	**6**	**0**	**78**	**50**	**50**

Internship

COURSE OVERVIEW

An internship can present students with new skills and opportunities. Interns not only gain technical knowledge within the industry of their choice, but they also learn how to interact with professionals in a workplace setting, and develop essential soft skills like time management, organization, adaptability, problem-solving and teamwork.

COURSE OBJECTIVE (S):

1. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
2. To encourage teamwork.
3. To help students to gain exposure into industries.
4. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3

CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

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

CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Internship:

- The internship should be paid internship in IT industry.
- The internship should be for minimum of three months.
- The project title must be submitted in form a document (synopsis) that contains the proposed title of the project, an abstract, Introduction and their roles and responsibilities in company.
- Each student shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the synopsis.
- Review 2 shall be on the presentation on the roles and responsibilities carried out with module competionresults(as applicable).

Global Certification

COURSE OVERVIEW

The Global Certification is a one semester intensive project based learning approach to cater with the Industry requirement. It prepares the students to up skill their knowledge base to compete in terms of latest technology and become competent enough to the industry requirment. In this, students will be able to solve complex real world problems pertaining to the domain chosen and gain confidence.It is an individual course and students have to earn the certificate based on their performances in terms of project assignment and aptitude. Student have to choose two Global certification courses.

COURSE OBJECTIVE (S):

1. To allow students to learn skills of their choice required in the current Industry perspective.
2. To encourage building multidisciplinary skill set through the integration of courses learned.

3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To prepare them to face the interview as professionals by improving communication skills.

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3

CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Global Certification

- Student should choose two Global certifications among the available Industry ready courses to cope up with the vast changing software world.
- Student should register for the course having minimum of 39 hours of teaching and should have 100 percent attendance for all the sessions.
- Each student shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the course, assignment completed followed by viva.
- Review 2 shall be on the presentation of their overall skills learned in the course followed by their certificate verification.

OPEN ELECTIVE-III:

Course Title	Java Programming				Course Type		Theory-OE	
Course Code	B20CSO701	Credits	3		Class		VIISemester	
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:

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.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

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	Explain the concept of generic class and methods.	1 to 5	1
CO6	Apply the garbage collection for saving the resources automatically in real world problem.	1 to 5	1

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	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	1	2		3		1				2		3		
CO6	3	1	2		3		1				2		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.

TEXTBOOKS:

1. Cay S. Horstmann, "Core Java® SE 9 for the Impatient", Addison Wesley, Second Edition, 2018.
2. HerbertSchild, "Java™:TheCompleteReference",McGraw-Hill,TenthEdition,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.

REFERENCEBOOKS:

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/)

JOURNALS/MAGAZINES:

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-LEARNINGEXERCISES:

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

VIII SEMESTER

Course Title	Capstone-Project Phase-2				Course Type		HC	
Course Code	B20EF0801	Credits	7		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	7	14	14	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**7**	**14**	**14**	**0**	**182**	**50**	**50**

COURSE OVERVIEW

Capstone-Project Phase-2 is continuation of Capstone-Project Phase-1 from semester VII.

COURSE OBJECTIVE (S):

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3

CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

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

CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Capstone-Project Phase-2:

- Each student group shall, conduct the required experiment to implement the proposed project with the consultation of respective guides.
- Each student groups shall be reviewed and evaluated in two reviews through the semester and finally each group shall demonstrate the completed project to a team of examiners.
- Review 1 shall be on the presentation of the methodology employed and model created.
- Review 2 shall be on the presentation on the functional project.
- Finally, the Capstone-Project Phase-2 shall conclude with each project group apply for patent or copyright and publish a paper in SCOPUS indexed journals.
- In Semester end examination, each student in groups shall be evaluated, based on the course outcomes.

Course Title	Internship/Global Certification				Course Type		HC	
Course Code	B20EF0802	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	3	6	3	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**6**	**3**	**0**	**78**	**50**	**50**

Internship

COURSE OVERVIEW

An internship can present students with new skills and opportunities. Interns not only gain technical knowledge within the industry of their choice, but they also learn how to interact with professionals in a workplace setting, and develop essential soft skills like time management, organization, adaptability, problem-solving and teamwork.

COURSE OBJECTIVE (S):

1. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
2. To encourage teamwork.
3. To help students to gain exposure into industries.
4. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3

CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

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

CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Internship:

- The internship should be paid internship in IT industry.
- The internship should be for minimum of three months.
- The project title must be submitted in form a document (synopsis) that contains the proposed title of the project, an abstract, Introduction and their roles and responsibilities in company.
- Each student shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the synopsis.
- Review 2 shall be on the presentation on the roles and responsibilities carried out with module competionresults(as applicable).

Global Certification

COURSE OVERVIEW

The Global Certification is a one semester intensive project based learning approach to cater with the Industry requirement. It prepares the students to up skill their knowledge base to compete in terms of latest technology and become competent enough to the industry requirment. In this, students will be able to solve complex real world problems pertaining to the domain chosen and gain confidence. It is an individual course and students have to earn the certificate based on their performances in terms of project assignment and aptitude. Student have to choose two Global certification courses.

COURSE OBJECTIVE (S):

1. To allow students to learn skills of their choice required in the current Industry perspective.
2. To encourage building multidisciplinary skill set through the integration of courses learned.

3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To prepare them to face the interview as professionals by improving communication skills.

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3

CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the Global Certification

- Student should choose two Global certifications among the available Industry ready courses to cope up with the vast changing software world.
- Student should register for the course having minimum of 39 hours of teaching and should have 100 percent attendance for all the sessions.
- Each student shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the course, assignment completed followed by viva.
- Review 2 shall be on the presentation of their overall skills learned in the course followed by their certificate verification.

Course Title	MOOC/COMPETITIVE EXAM				Course Type		HC	
Course Code	B20EF0803	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	3	6	6	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**3**	**6**	**6MACH**	**0**	**78**	**50**	**50**

COURSE OVERVIEW

The MOOC Course is a one semester intensive project-based learning approach to cater with the Industry requirement. It prepares the students to up skill their knowledge base to compete in terms of latest technology and become competent enough to the industry requirment. In this, students will be able to solve complex real-world problems pertaining to the domain chosen and gain confidence. It is an individual course and students have to earn the certificate based on their performances in terms of project assignment and aptitude. Student have to choose oneMOOC course.

COURSE OBJECTIVE (S):

1. To allow students to learn skills of their choice required in 507507
2. the current Industry perspective.
3. To encourage building multidisciplinary skill set through the integration of courses learned.
4. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
5. To prepare them to face the interview as professionals by improving communication skills.

COURSE OUTCOMES (CO'S):

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3

CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	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			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

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

The students are informed to follow the following instructions to complete the MOOC/COMPETITIVE EXAM:

- Student should choose one **MOOC/COMPETITIVE COURSE**among the available Industry ready courses to cope up with the vast changing software world.
- Student should register for the course having minimum of 39 hours of teaching and should have 100 percent attendance for all the sessions.
- Each student shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the course, assignment completed followed by viva.
- Review 2 shall be on the presentation of their overall skills learned in the course followed by their certification verification.

Open Elective-IV :

Course Title	R Programming Language				Course Type		Theory-OE	
Course Code	B20CSO801	Credits	3		Class		VIII 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:

This course focus on the programming in R for the effective data analysis and configuring software for statistical programming environment. The course also covers the practical issues in statistical computing which includes programming in R, reading data, accessing packages, debugging. This initiates the learning in real time data.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Discuss the basics of R programming.

2.Demonstrate the use of Control Structures, Functions.

3.Illustrate the use of features of text processing in real world applications.

4.Describe the models with respect to statistical analysis.

COURSEOUTCOMES(COs)

Afterthecompletionofthecourse,thestudentwillbeableto:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the basics in R programming in terms of constructs, control statements, string functions.	1 to 5	1, 2, 3
CO2	Make use of R for BigData analytics in real world applications.	1 to 5	1, 2, 3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1, 2, 3
CO4	Develop R programming for a statistical real time problems.	1 to 5	1, 2, 3
CO5	Apply R programming concepts to plot, customize and save graphs to files for real world applications.	1 to 5	1
CO6	Make use of list operations for processing the raw data in data analytics.	1 to 5	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	2	1	2								3	3	3
CO2	3	3	2	2	3								3	3	3
CO3	3	3	2	2	2								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	2	2	1	2								3		
CO6	3	2	3	2	3								3	3	

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

COURSE CONTENT

THEORY:

UNIT-1

Introducing to R: R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT-2

Matrices, Arrays And Lists: Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists .

UNIT-3

Data Frames: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion –Replacement functions – Tools for composing function code – Math and Simulations in R .

UNIT-4

OOP:S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

TEXTBOOKS:

1. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

REFERENCEBOOKS:

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and programming in R", Amazon Digital South Asia Services Inc, 2013.

JOURNALS/MAGAZINES:

1. Journal of applied statics
2. Computational Statistics & Data Analysis
3. The Annals of Statistics

SWAYAM/NPTEL/Moocs:

1. Coursera course on R Programming - Johns Hopkins University
2. Introduction To R Programming – NPTEL Course

SELF-LEARNINGEXERCISES:

Interfacing: Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – GeneralizedLinear models – Non-linear models – Time Series and Auto-correlation – Clustering.