REVA UNIVERSITY

Bengaluru, India

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

B. TECH – COMPUTER SCIENCE & ENGINEERING

2017-2021

Rukmini Educational Charitable Trust

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

HANDBOOK

B. Tech. in Computer Science & Engineering

2017-21

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Rukmini Educational
Charitable Trust

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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 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 across the globe.

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

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

At REVA University, research, consultancy and innovation are regarded as our pillars of success.

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

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

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

Welcome to the portals of REVA University!

Dr. S Y Kulkarni
Vice-Chancellor, REVA University

Director's – Message

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

This handbook presents the B.Tech in 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 school has well qualified faculty members in the various areas of computing and IT including cloud computing, security, IOT, AI, ML and DL, software engineering, computer networks, cognitive computing, etc. State of art laboratories are available for the purpose of academics and research. The curriculum caters to and has relevance to local, regional, national, global, development needs. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

Prof. Dr. Sunilkumar S. Manvi,
Director, School of Computing and IT

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RUKMINI EDUCATIONAL CHARITABLE TRUST

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

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

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

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7th February, 2013. The University is recognized 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 Intelligence, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, , LED Lighting, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor and Dean, and supported by well experienced Trainers, 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. VS 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 Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical

education department conducts regular yoga classes every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

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

Vision (REVA University Vision)

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

Mission

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

Objectives

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

ABOUT THE SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY (C & IT)

The School has a rich blend of experienced and committed faculty who are well qualified in various aspects of computing and information technology apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The School offers one undergraduate program: B Tech in Computer Science and Engineering. Two post graduate programs offered in the school are: M Tech in Data Engineering and Cloud Computing and M Tech in Computer Science and Engineering. In addition, the school has a unique academic collaboration with the University of Alabama in Huntsville to jointly offer an MS program in Computer Science. In addition, the school 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

To create a pool of high-caliber engineers and researchers in computer science and information technology contributing to the development of the nation and the society with their expertise, skills, innovative problem-solving abilities and strong ethical values.

Mission

- Create a center of excellence where new ideas flourish and from which emerge tomorrow's researchers, scholars, leaders and innovators.
- Provide quality education in both theoretical and applied foundations of computer science, information technology and related inter-disciplinary areas and to train students to effectively apply the education to solve real-world problems.
- Amplify students' potential for life-long high-quality careers and give them a competitive advantage in the ever-changing and challenging global work environment of the 21st century.
- Forge research and academic collaboration with industries and top global universities in order to provide students with greater opportunities.
- Support the society by encouraging and participating in technology transfer.

Advisory Board

Sl.No	Name and Designation of the Members
1	**Mr. Himesh Misra, Program Director**, IBM Innovation Center, IBM India Private Limited Bengaluru
2	**Dr. Rajkumar Buyya, Director**, Cloud Computing and Distributed Systems Laboratory Department of Computing and Information Systems University of Melbourne, Australia
3	**Mr. ChethanShivkumar, Founding Director**, AIKAAN Labs, Bengaluru
4	**Mr. P. B. Kotur, Global Goodwill Ambassador** Wipro Limited Bengaluru, India
5	**Dr. Sajal Das, Professor,** Department of CS&E Missouri University of Science and Technology, USA
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7	**Mr. Mrityunjay Hiremath, Director,** AMD Inc. USA, Bengaluru, India

MEMBERS OF BOARD OF STUDIES

Sl. No	Name and Affiliation	Role
1	**Dr Sunil Kumar S Manvi, Professor and Director** School of C & IT, REVA University	Chairman
2	**Dr Mallikarjuna Shastry P M, Professor** School of C & IT, REVA University	Member
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4	**Prof Ashwin Kumar U M, Associate Professor**, School of C & IT, REVA University	Member
5	**Dr Gopala Krishna Shyam, Associate Professor,** School of C & IT, REVA University	Member
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9	**Dr Sanjay, HoD Dept. of ISE**, NITTE Meenakshi Institute of Technology, Bengaluru	Member
10	**Dr Raghavendra Kulkarni, Director of Academics**, M. S. Ramaiah University of Applied Sciences, Bengaluru	Member

Program Overview

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

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

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 higher level degrees help the graduates to pursue a career in academics or scientific organizations as researchers.

The Program Educational Objectives (PEOs) :

PEO-1	Have successful professional careers in industry, government, academia and military as innovative engineer in a team
PEO-2	Develop code and solutions to industry in a rapid changing technology environment and communicate with clients as an entrepreneur
PEO-3	Pursue higher studies and continue to learn by participating conferences, seminars etc

Program Outcomes (POs)

After undergoing this programme, a student will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering.

PO2. Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3. 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.

PO4. 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.

PO5. 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.

PO6. 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.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10. 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.**

PO11. 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.

PO12. 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 (PSO)

After successful completion of the programme, the graduates will be able to

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.

2. Solve latest problems and develop code to address the requirements of Industry through programming.

3. Use modern tools and techniques in the area of Computer Science and Engineering.

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Four Year Graduate Degree Programs

1. Teaching and Learning Process:

The Teaching & Learning process under CBCS – CAGP of education in each course of study will have three components, namely**:** L:T:P.

(i) L= Lecture (ii) T= Tutorial (iii) P=Practice, where:

L stands for **Lecture** session consisting of classroom instruction.

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

P stands for **Practice** session and it consists of Hands-on Experience / Laboratory Experiments / Field Studies / Case Studies that equip students to acquire the much-required skill component.

2. Courses of Study and Credits

a. The study of various subjects in B Tech degree program are grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

b. 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.

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

d. **A course shall have either or all the four components.** That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

e. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T +P.

3. Courses of Study

Different C**ourses of Study** are labeled and defined as follows:

a. Core Course:

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Corecourse. The CORE courses of Study are of THREE types, viz–

(i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. Foundation Course (FC):

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

c. Hard Core Course (HC):

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

d. Soft Core Course (SC):

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

e. 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 O**pen Elective Course.**

f. Project Work /Dissertation:

Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A project work carrying **FOUR or SIX** credits is called **Minor Project** work/**Dissertation.** A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called **Major Project** work/**Dissertation**. **A Minor Project work may be a hard core or a Soft Core as decided by the BoS / concerned. But the Major Project shall be Hard-core.**

3. Scheme, Duration and Medium of Instructions:

3.1 B Tech degree program is of 8 semesters - 4 years duration. A candidate can avail a maximum of16semesters-8years as per double duration norm, in one stretch to complete BTech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Minimum Credits to be Earned

4.1 A candidate has to earn 192 credits for successful completion of B Tech degree with the distribution of credits for different courses as prescribed by the university. A candidate can enroll for a maximum of 32 credits and a minimum of 20 credits per Semester.

4.2 However he/she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

4.3 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 192 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.

4.3. 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 192 credits for the B Tech Degree program.

4.3.1. Add on Proficiency Diploma:

To acquire **Add on Proficiency Diploma,** a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 192 credits for the B Tech Degree program.

The A**dd on Proficiency Certification/Diploma** so issued to the candidate contains the courses studied and grades earned.

5. Scheme of Assessment and Evaluation

5.1. The Scheme of Assessment and Evaluation will have two parts, namely;

i. Internal Assessment (IA); and
ii. Semester End Examination (SEE)

5.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester

End Examination (SEE) of UG Engineering programs shall carry 40:60 marks respectively (i.e., 40 marks internal assessment; 60 marks semester end examination).

5.3. The 40 marks of internal assessment shall comprise of:

Internal Test	= 30marks
Assignments / Seminars / Model Making etc.	= 10marks

6. Assessment of Performance in Practical's

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

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

6.2. The 40 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated asunder:

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.	10 marks
	Total	**40 marks**

6.3. The 60 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conduction of semester end practical examination	40 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**60 marks**

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

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

7.1. Right from the initial stage of defining the problem, the can did at 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 maybe, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Results of Work and Draft Report (25%)
Component– III	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

8. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Mid-term Tests and Assignments), he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the candidate if his/her

submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

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

- The Registrar (Evaluation) - Ex-officio Chairman /Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines –Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department –Member.

9. Eligibility to Appear for Semester End Examination (SEE)

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

10. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

10.1 Requirements to Pass a Course

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 40 + SEE = 60) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25%(15marks) in Semester End Examination (SEE) which is compulsory.

10.2 Provision to Carry Forward the Failed Subjects /Courses:

The total number of "F" Grades that can be carried forward by a student at the end of any even semester shall not be more than four courses.

10.3. Re-Registration and Re-Admission:

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

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

11. Attendance Requirement:

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

11.2. In case a student is on approved leave of absence (eg:- 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.

11.3. 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 as provided in10.3.

11.4. Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of Semester end examination, and subsequently a notification.

11.5. pertaining to the above will be brought out by the Director of the School before the commencement of Semester end examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar(Evaluation).

11.6. Absence during Internal Test:

In case a student has been absent from a internal tests due to the illness or other contingencies he /she may give a request along with necessary supporting documents and certification from the concerned class teacher/authorized personnel to the concerned Head of the School, for conducting a separate internal test. The Head of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher and arrange to conduct a 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.

12. Grade Card and Grade Point

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

12.2. 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 Registrar(Evaluation).

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

Marks P	Grade G	Grade Point (GP=V x G)	Letter Grade
90 >100	10	v*10	O
80 > 90	9	v*9	A+
70 > 80	8	v*8	A
60 > 70	7	v*7	B+
55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C+
40 > 50	5	v*5	C
0-40	0	v*0	F

ABSENT	AB

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

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

12.3.1. 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 i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	4	A+	9	4X9=36
Course 2	4	A	8	4X8=32
Course 3	3	B+	7	3X7=21
Course 4	3	O	10	3X10=30
Course 5	3	C	5	3X5=15
Course 6	3	B	6	3X6=18
Course 7	2	O	10	2X10=20
Course 8	2	A	8	2X8=16
	24			188

Thus, **SGPA = 188 ÷ 24 = 7.83**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	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**

12.4. Cumulative Grade Point Average(CGPA):

12.4.1. Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (192) 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 i^{th} semester and Ci is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	26	7.40	26 x 7.40 = 192.4
5	26	8.29	26 x 8.29 = 215.54
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222
Cumulative	196		1588.26

Thus, **CGPA** = $\frac{24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25}{196}$ = 8.10

12.4.2. 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 8.10 x 10=81.0

12.5. Classification of Results

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

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

Overall percentage=10*CGPA

13. 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 Registrar (Evaluation) within 10 days after the announcement of the results. **This challenge valuation is only for semester end examination.**

b. The answer scripts for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

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

B. Tech in Computer Science and Engineering for the Batch 2017-21

Eligibility for Admission:

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

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B Tech)	4 Years	Passed 10+2 examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry Biotechnology / Biology / 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 atleast 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 atleast 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 student sbe longing 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 yearsubjects. **(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 (BTech)	Lateral entry to fourth ye ar (final year)	**(F)** Provided further that Students who successfully completed six Semesters in REVA University and have exited with Advanced Diploma in Engineering &Technology (ADET) shall be eligible for admission to the Fourth year B Tech degree courses subject to the vacancies. **(G)** 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.

Scheme

and

Syllabus of

B. Tech in Computer Science and Engineering

for

2017-2021

Rukmini Educational
CharitableTrust
A UNIT – of DivyaSree

REVA UNIVERSITY

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

Scheme of Instructions and

Syllabus Approved

by

Board of Studies

Ref: BOS/CIT/BCS/2013-14/2/04-02-2014

Ref: BOS/CIT/BCS/2014-15/3/14-03-2015

Ref: BOS/CIT/BCS/2015-16/4/02-04-2016

Ref: BOS/CIT/BCS/2016-17/5/08-04-2017

B. Tech in Computer Science and Engineering

Batch: 2017-2021

Scheme of Instructions and Syllabus

Batch 2017-2021
B.Tech – I / II Semester

Scheme for I Semester									
PHYSICS CYCLE									
Sl. No	**Course code**	**Title of the Course**	**Types of course HC/ SC/OE**	**Credit Pattern & Credit Value**				**Contact Hrs**	**Teaching School/Dept**
				L	**T**	**P**	**Total**		
1	BTEM15F1100	Engineering Mathematics – I	HC	3	1	0	4	5	Mathematics
2	BTEP15F1200	Engineering Physics	HC	2	1	0	3	4	Physics
3	BTCV15F1300	Elements of Civil Engineering	HC	2	1	0	3	4	Civil
4	BTME15F1400	Elements of Mechanical Engineering	HC	2	1	0	3	4	Mechanical
5	BTEE15F1500	Basic Electrical Engineering	HC	2	1	0	3	4	Electrical
6	BTIC15F1600	Indian Constitution and Professional Ethics	FC	1	1	0	2	3	Humanities
7	BTCE15F1700	Technical English – I	FC	1	1	0	2	3	Humanities
8	BTPL15F1800	Engineering Physics Lab	HC	0	0	2	2	3	Physics
9	BTEW15F1900	Basic Electrical Engineering lab	HC	0	0	2	2	3	Electrical
Total Credits				**13**	**7**	**4**	**24**	**33**	
Scheme for II Semester									
CHEMISTRY CYCLE									
1	BTEM15F2100	Engineering Mathematics – II	HC	3	1	0	4	5	Mathematics
2	BTEC15F2200	Engineering Chemistry	HC	2	1	0	3	4	Chemistry
3	BTEC15F2300	Basic Electronics Engineering	HC	3	0	0	3	4	Electronics
4	BTCC15F2400	Computer Concepts & C Programming	HC	2	1	0	3	4	CSE
5	BTES15F2500	Environmental Sciences	FC	1	1	0	2	3	Civil
6	BTCC15F2600	Technical English – II	FC	1	1	0	2	3	Humanities
7	BTED15F2700	Computer Aided Engineering Drawing	HC	2	0	2	4	6	Mechanical
8	BTCL15F2800	Engineering Chemistry Lab	HC	0	0	2	2	3	Chemistry
9	BTCP15F2900	Computer Programming Lab	HC	0	0	2	2	3	CSE
Total Credits				**13**	**6**	**6**	**25**	**35**	

Scheme of Instructions for B.Tech in CSE– III to VIII Semester for 2017-21 Batch

Course Code		Course Title	Course Type	Credit Pattern andCredit Value				Contact Hrs.	Teaching School/ Dept.
				L	T	P	C		
Third Semester									
1	BTCS15F3100	Discrete Mathematical Structures	HC	2	1	0	3	4	Mathematics
2	BTCS15F3200	Data Structures and Algorithms	HC	2	1	0	3	4	C&IT
3	BTCS15F3300	Advanced Computer Programming	HC	2	1	1	4	6	C&IT
4	BTCS15F3400	Digital Principles and Logic Design	HC	2	1	0	3	4	C&IT
5	BTCS15F3500	Computer Organization and Architecture	HC	3	1	0	4	5	C&IT
6	BTCS15F3600	Engineering Mathematics-III	HC	3	1	0	4	5	Mathematics
7	BTCS15F3700	Data Structures Lab	HC	0	0	2	2	3	C&IT
8	BTCS15F3800	Logic Design& Electronic Circuits Lab	HC	0	0	2	2	3	C&IT
Total Credits for the Third Semester:							**25**	34	
Fourth Semester									
1	BTCS15F4100	Graph Theory	HC	3	1	0	4	5	Mathematics
2	BTCS15F4200	Engineering Mathematics-IV	HC	2	1	0	3	4	Mathematics
3	BTCS15F4300	Design and Analysis of Algorithms	HC	2	1	0	3	4	C&IT
4	BTCS15F4400	Microcontrollers	HC	2	1	0	3	4	C&IT
5	BTCS15F4500	Finite Automata and Formal Languages	HC	3	1	0	4	5	C&IT
6	BTCS15F4600	System Software	HC	3	0	1	4	5	C&IT
7	BTCS15F4700	Design and Analysis of Algorithms Lab	HC	0	0	2	2	3	C&IT
8	BTCS15F4800	Microcontrollers Lab	HC	0	0	2	2	3	C&IT
Total Credits for the Fourth Semester:							**25**	33	
Fifth Semester									
1	BTCS15F5100	Operating System and Unix Internals	HC	3	0	0	3	3	C&IT
2	BTCS15F5200	Object Oriented Programming using C++	HC	3	0	1	4	5	C&IT
3	BTCS15F5300	Database Management System	HC	3	0	0	3	3	C&IT
4	BTCS15F5400	Software Ethics and Project Management	HC	3	0	0	3	3	C&IT
5	BTCS15F5500	Computer Network Concepts and Protocols	HC	3	1	0	4	5	C&IT
6	BTCS15F56X0	Soft-core Group 1 (SC-1)	SC	-	-	-	3	-	C&IT
7	BTCS15F5700	Operating System Lab	HC	0	0	2	2	3	C&IT
8	BTCS15F5800	Database Management System Lab	HC	0	0	2	2	3	C&IT
Total Credits for the Fifth Semester:							**24**	25	
Sixth Semester									

1	BTCS15F6100	Software Engineering and Testing	HC	3	0	1	4	5	C&IT
2	BTCS15F6200	Virtualization and Cloud Computing	HC	3	1	0	4	5	C&IT
3	BTCS15F6300	Cryptography and Network Security	HC	3	0	0	3	3	C&IT
4	BTCS15F64X0	Soft-core Group 2 (SC-2)	SC	-	-	-	4	-	C&IT
5	BTCS15F65X0	Soft-core Group 3 (SC-3)	SC	-	-	-	4	-	C&IT
6	BTCS15F6600	Computer Network Simulation & Programming Lab	HC	0	0	2	2	3	C&IT
7	BTCS15F6700	Mini Project	HC	0	1	3	4	8	C&IT
Total Credits for the Sixth Semester:							**25**		
Seventh Semester									
1	BTCS15F7100	Machine Learning and Applications	HC	3	0	1	4	5	C&IT
2	BTCS15F7200	**Open Elective**	OE	-	-	-	4	-	Other Depts
3	BTCS15F73X0	Softcore Group 4 (SC-4)	SC	-	-	-	4	4	C&IT
4	BTCS15F74X0	Softcore Group 5 (SC-5)	SC	-	-	-	4	4	C&IT
5	BTCS15F75X0	Softcore Group 6 (SC-6)	SC	-	-	-	4	-	C&IT
6	BTCS15F7600	Cloud Computing Lab	HC	0	0	2	2	4	C&IT
7	BTCS15F7700	Web Applications Lab	HC	0	0	2	2	4	C&IT
8	BTCS15F7800	Project Work Phase-1	HC	0	0	0	2	-	C&IT
Total Credits for the Seventh Semester:							**26**		
Eighth Semester (Choose any one option) **Option- 1: Course Work and Project**									
1	BTCS15F81X0	Softcore Group 7 (SC-7)	SC	-	-	-	4	-	C&IT
2	BTCS15F82X0	Softcore Group 8 (SC-8)	SC	-	-	-	4	-	C&IT
3	BTCS15F8300	Project Work Phase-2	**HC**	**0**	**2***	**8**	**10**	**14**	**C&IT**
Total Credits for the Eighth Semester with Option-1:							**18**		
Option- 2: Internship and Project									
1	BTCS15F8400	Internship	SC	-	-	-	8	-	C&IT
2	BTCS15F8300	Project Work Phase-2	**HC**	**0**	**2***	**8**	**10**	**14**	**C&IT**
Total Credits for the Eighth Semester withOption-2:							**18**		
Opton-3: Skill Development and Project									
1	BTCS15F8100	Global Certification Program-1	**SC**	-	-	-	4		C&IT
2	BTCS15F8200	Global Certification Program-2	**SC**	-	-	-	4		C&IT
3	BTCS15F8300	Project Work Phase-2	HC	0	2*	8	10	14	C&IT
Total Credits for the Eighth Semester withOption-3:							**18**		

S **Total Credits for all Eight Semesters:**	**192**

***Project work done in 8th semester should be published in a reputed National/International Journal to earn 2 credits.**

Guide lines for Internship/Project Work/Global Certification Programs

1. **Internship:** should be carried out in a reputed /Tier-1/R & D organization, preferably, internship should be with stipend. The internship should be approved by the REVA University authorities before completion of 3rd semester and the students should obtain the permission for the same by producing the necessary details of company, selection process, and the offer letter issued by the company. At the end of the Internship, detailed report must be submitted.
2. Students can take-up the **internship** only if it is approved by RU authorities.

3. **Project work phase 1** comprises of literature survey, review paper writing, and problem formulation, identification of tools and techniques, and methodology for the project. **Project work phase – 2**, in 4thsemester should have an outcome: publication in a reputed National/International Journal or a patent filing to earn 2 credits
4. **Global Certification programs:** Students have to register for global certification programs of their choice such as networking, JAVA, ORACLE, etc. The students can also choose skill development programs conducted by the UIIC or School, which may not be globally certified. However, weightage is more for global certification courses (10% weightage is accounted less for non-global programs). The registration must happen before beginning of the third semester.

Guidelines for Evaluation of Project Work/Internship/ Skill Development Global Certification Program

1. Evaluation of Major/MinorProject

Sl.No	Examination	Max. Marks	Requirements/Documents To Be Submitted	Tentative Schedule
1	C1	25	1.Synopsis Report 2.Weekly progress Reports 3.Presentation	6 weeks from semester start date
2	C2	25	1. MID-TERM report 2. Weekly progress Reports 3. Presenation	6 weeks from C1
3	C3	20 marks for Viva 30 marks for Thesis Total 50	1. Thesis Report 2. Weekly Progress Reports. 3.FinalPresentation	Two weeks from C2

2. Evaluation ofInternship

Sl.No.	Exam	Max.Marks	Documents To Be Submitted	Tentative Scheduling
1	C1	25	1.Synopsis Report/PHASE-1 2.Presenation	6 weeks from semester start date
2	C2	25	1. MID-TERM report/PHASE-2 2. Presenation	6 weeks from C1
3	C3	20 marks for Viva 30 marks for Thesis Total 50	1. Internship 2. Final Report 3.Final Presentation	Two weeks from C2

Evaluation of Global Certification Program

Sl.No	EXAM	MAX.MARKS	Documents To Be Submitted	Tentative Scheduling
1	C1	25	1. PHASE-1 Report on their topic of Certification. 2. Presentation.	6 weeks from semester start date
2	C2	25	1. MID-TERM report/ PHASE-2 on Their Topic of Certification. 2.Presenation	6 weeks from C1

3	C3	20 marks for Viva 30 marks for Thesis Total 50	1. Final Report 2. Final Presentation 3. Global Certificate.	Two weeks from C2

List of Open Elective Courses offered by the School of Computing and IT

a. Data Structures Using C

b. Internet Computing and Applications

c. Linux Operating Systems

Semester-Wise Soft-core Groups													
Semester	Soft core Group	Data Engineering		System Architecture and Design		Robotics and Computer Vision		Communication &Networking		Programming		Others	
		Code	Subject	Code	Subject	Code	Subject	Code	Subject	Code	Subject	Code	Subject
V	SC-1 (3)			BTCS 15F55 10	Electro nic System Design (3:0:0)	BTCS15 F5520	Signals and System s (3:0:0)	BTCS15 F5530	Digital Commu nicatio n (3:0:0)	BTCS1 5F554 0	Program mingLan guages and Compile r (3:0:0)	BTCS15 F5550	Object Oriente d Modelin g and Design (3:0:0)
VI	SC-2 (4)	BTCS 15F6 410	Data Minin g Techni ques (3:1:0)	BTCS 15F64 20	Embed ded System s &Inter net of Things (3:0:1)	BTCS15 F6430	Digital Image Processi ng (3:1:0)	BTCS15 F6440	Distribu ted Comput ing System s (3:1:0)	BTCS1 5F645 0	Unix Syste m Progr am ming (3:0:1)	BTCS15 F6460	Researc h Methodo logy in IT (2:1:1)
	SC-3 (4)	BTCS 15F6 510	Intelli gent Agent s (3:1:0)	BTCS 15F65 20	Multic ore Archite ctu re and Progra mming (3:0:1)	BTCS15 F6530	Soft Computi ng (3:1:0)	BTCS15 F6540	Advanc e d Compu t er Networ k s(3:1:0)	BTCS1 5F655 0	Progra m ming with Java (3:0:1)		
VII	SC-4	BTCS 1 7F731 10	Big Data and Hadoo p (3:0:1)	BTCS1 5F732 0(3:0:1)	High Perfor mance Comput ing	BTCS15 F7330	Pattern Recogni tion (3:1:0)	BTCS15 F7340	Networ k Manag ement System s (3:1:0)	BTCS1 7F73 50	Netw ork Progr am ming (3:0:1)		
	SC-5	BTCS 15F7 410	Advan ce d Databas e Mana ge ment Syste m (3:1:0)	BTCS 15F74 20	VLSI Design &algori thms (3:1:0)			BTCS15 F7430	Multim edia Co mputin g &Netw ork s (3:1:0)	BTCS1 5F744 0	Web Technol ogy (3:0:1)	BTCS17 F7450	Compute r Graphics and Visualizat ion (3:0:1)
	SC-6					BTCS15 F7510	Human Compute r Interacti o n (3:1:0)	BTCS15 F7520	Wireles s and Mobile Networ k s(3:1:0)	BTCS1 5F753 0	Progra m mingwi th Python (3:0:1)	BTCS15 F7540	Cloud Securit y (3:1:0)

VIII	**SC-7**	BTCS 15F8 110	Storag e Area Netwo rk s (3:1:0)	BTCS 15F81 20	Softw are Archite cture (3:1:0)	BTCS15 F8130	Real Time Systems (3:1:0)	BTCS15 F8140	Mobile Computi ng and Applicati on Develop ment (3:0:1)	BTCS1 5F81 5 0	User interfa ce Design and Develo pment (3:0:1)	BTCS15 F8160	Optimiza tion Techniq u es & Game Theory(3: 1:0)
	SC-8	BTCS 1 5F82 1 0	Data Analyti cs Tools(3 : 0:1)	BTCS 15F82 20	System Modeli ng and Simulat ion (3:1:0)	BTCS1 5F823 0	Multimed ia Systems (3:1:0)	BTCS15 F8240	Softwar e Define d Networ ks and Networ k Virtuali zation (3:1:0)	BTCS1 5F825 0	C# and. Net (3:0:1)		

Mapping of Course Outcomes with programme Outcomes

(Notations: L=Low or 1, M=Medium or 2, H=High or 3)

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
BTEM15F1100	CO1	H	H	H	M	H	L	-	-	-	-	-	-	H	-	M
	CO2	H	H	H	M	M	L	-	-	-	-	-	-	-	-	M
	CO3	H	H	M	M	M	M	-	-	-	-	-	-	-	-	M
	CO4	H	M	M	M	M	L	-	-	-	-	-	-	H	-	-
BTEP15F1200	CO1	H	H	H	-	-	-	-	L	L	-		M	M	-	
	CO2	H	H	M	-	-	-	-	-	L	L		M	M	-	
	CO3	H	M	-	H	-	-	-	-	-	L		M	M	H	-
	CO4	H	M	M	H	-	-	-	-	-	L	M	M	M	H	-
BTCV15F1300	CO1	H	H	M	L	H	L		-	-	-	L	H	M	-	-
	CO2	H	H	H	L	L	-		-	-	-	L	M	M		H
	CO3	H	H	M	L	L	L		-	-	-	L	M	M		H
	CO4	H	H	L	L	M	L		-	-	-	L	H	M	-	-
BTME15F1400	CO1	H	H	M	L	-	-	-	-	-	-	-	-	-	-	-
	CO2	H	H	H	M	-	-	-	-	-	-	-	-	-	-	-
	CO3	H	M	L	H	-	-	-	-	-	-	-	-	-	-	-
	CO4	H	M	L	H	-	-	-	-	-	-	-	-	-	-	-
BTEE15F1500	CO1	M	L	H	L	M	H	-	-	-	-	-	-	-	-	-
	CO2	L	H	M	M	H	-	-	-	-	-	-	-	-	-	-
	CO3	M	M	M	M	L	-	-	-	-	M	-	-	H	-	-
	CO4	H	H	H	H	L	-	-	-	-	-	-	-	-	-	-
BTIC15F1600	CO1	M	L	H	L	-	H	M	H	H	-	M	L	H	L	-
	CO2	L	H	M	M	-	H	M	H	H	-	M	H	M	M	-
	CO3	M	M	M	M	-	H	M	H	L	-	M	M	M	M	-
	CO4	H	H	H	H	-	H	M	H	L	-	M	H	H	H	-
BTCE15F1700	CO1	H	-	H	H	H	H	H	H	H	L	L	M	H	H	H
	CO2	H	-	H	H	H	H	H	H	H	L	L	M	H	H	H
	CO3	H	-	H	H	H	H	H	H	H	L	L	M	H	H	H
	CO4	H	-	H	H	H	H	H	H	H	L	L	M	H	H	H
BTPL15F1800	CO1	M	M	-	-	-	M	-	-	H	H	M	M	-	H	-
	CO2	M	M	-	-	-	M	-	-	H	H	M	M	-	H	-
	CO3	M	M	-	-	-	M	-	-	M	M	M	M	-	H	-
	CO4	M	M	-	-	-	M	-	-	M	M	M	M	-	H	-
BTEW15F1900	CO1	H	-	L	M	-	-	-	-	H	-	-	-	-	-	-
	CO2	M	L	-	M	-	-	-	-	-	-	-	-	-	-	-
	CO3	L	M	M	-	-	-	-	-	-	-	H	-	H	-	-
	CO4	-	M	M	L	-	-	-	-	-	-	-	-	-		-
BTEM15F2100	CO1	H	H	H	H	-	-	-	-	-	-	-	-	H	H	H
	CO2	H	H	M	H	-	-	-	-	-	-	-	-	H	-	-
	CO3	H	H	M	H	-	-	-	-	-	-	-	-	H	-	-
	CO4	H	H	M	H	-	-	-	-	-	-	-	-		-	-
BTEC15F2200	CO1	M	L	L	-	-	-	-	-	-	-	-	-	-	-	-
	CO2	M	L	H	M	M	M	M	-	-	-	-	-	-	-	-
	CO3	M	M	H	H	L	M	L	-	-	-	-	-	-	-	-
	CO4	H	H	M	M	M	L	M	-	-	-	-	-	H	-	-
BTEC15F2300	CO1	H	M	L	-	M	-	-	-	-	-	-	-	H	M	H
	CO2	H	H	M	-	M	-	-	-	-	-	-	-	H	H	H
	CO3	H	M	H	L	M	-	-	-	L	L	-	-	H	M	H
	CO4	H	H	H		M	-	-	-	L	L	-	-	H	H	H
BTCC15F2400	CO1	H	H	H	M	M	-	-	-	-	-	-	H	H	H	H
	CO2	H	M	H	H	M	-	-	-	-	-	-	H	H	H	H
	CO3	H	M	H	H	M	-	-	-	-	-	-	H	H	H	H
	CO4	H	H	H	H	M	-	-	-	-	-	-	H	H	H	H
BTES15F2500	CO1	H	H	H	H	H	H	H	M		M		M	H	H	-
	CO2	H	M	H	H	M	H	H		H		H		H	H	-

	CO3	H	M	H	H	M	H	M	M	M		M	M	H	M	-
	CO4	H	H	H	H	H	H	H		H	M	H		H	H	-
BTCC15F2600	CO1	-	-	-	-	-	-	-	H	L	H	L	H	H	H	-
	CO2	-	-	-	-	-	-	-	H	L	H	L	H	H	H	-
	CO3	-	-	-	-	-	-	-	H	L	H	L	H	H	H	-
	CO4	-	-	-	-	-	-	-	H	L	H	L	H	H	H	-
BTED15F2700	CO1	H	M	M	L	H	-	-	-	-	-	-	-	-	-	-
	CO2	H	L	L	L	H	-	-	-	-	-	-	-	-	-	-
	CO3	H	H	H	M	H	-	-	-	-	-	-	-	-	-	-
	CO4	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
BTCL15F2800	CO1	H	H	L	L	-	M	-	-	H	H	-	-	H	-	-
	CO2	H	H	L	-	-	M	M	-	H	H	-	-	H	-	-
	CO3	H	H	-	-	-	M	M	-	H	H	-	-	H	-	-
	CO4	H	H	L	-	-	L	L	-	H	H	-	-	H	-	-
BTCP15F2900	CO1	H	M	M	-	M	-	-	-	-	-	-	-	H	-	-
	CO2	H	H	M	M	M	-	-	-	-	-	-	-	H	H	H
	CO3	H	H	M	M	M	-	-	-	H	H	-	-	H	H	-
	CO4	H	M	L	L	-	-	-	-	H	H	-	-	H	H	H
BTCS15F3100	CO1	H	H	M	M	H	H	-	-	-	-	-	-	-	H	-
	CO2	H	H	H	H	H	H	-	-	-	-	-	-	-	-	H
	CO3	H	H	M	M	H	H	-	-	-	-	-	-	H	-	-
	CO4	M	H	M	H	H	H	-	-	-	-	-	-	H	-	-
BTCS15F3200	CO1	H	H	M	H	H	-	-	H	H	H	-	H	H	H	H
	CO2	H	H	H	H	H	-	-	H	H	H	-	H	H	H	H
	CO3	H	L	M	H	L	-	-	H	H	H	-	H	H	H	H
	CO4	H	L	H	H	M	-	-	H	H	H	-	H	H	H	H
BTCS15F3300	CO1	H	H	M	M	-	-	-	H	H	H	-	-	-	H	-
	CO2	H	H	M	M	-	-	-	H	H	H	-	-	H	-	-
	CO3	H	L	H	M	-	-	-	H	H	H	-	H	-	H	-
	CO4	H	M	M	M	-	-	-	H	H	H	-	H	-	-	-
BTCS15F3400	CO1	H	H	H	H	M	-	-	-	-	-	-	-	H	H	-
	CO2	H	M	H	M	H	-	-	H	H	H	-	H	-	-	H
	CO3	H	M	H	H	M	-	-	H	H	H	-	-	-	-	H
	CO4	H	H	H	M	L	-	-	-	-	-	-	-	H	H	-
BTCS15F3500	CO1	H	H	H	H	M	-	-	-	-	-	-	-	H	H	-
	CO2	H	M	H	M	H	-	-	H	H	H	-	H	-	-	H
	CO3	H	M	H	H	M	-	-	H	H	H	-	-	-	-	H
	CO4	H	H	H	M	L	-	-	-	-	-	-	-	H	H	-
BTCS15F3600	CO1	H	H	H	M	M	L	L	-	-	-	-	-	-	--	H
	CO2	H	H	H	M	M	L	H	-	-	-	-	-	H	H	H
	CO3	H	H	M	H	M	H	L	-	-	-	-	-	H	H	-
	CO4	H	H	M	M	H	H	L	-	-	-	-	-	-	-	-
BTCS15F3700	CO1	M	H	H	L	M	L	M	H	H	L	-	-	H	-	H
	CO2	H	H	M	H	H	H	H	H	M	H	-	-	H	-	-
	CO3	H	M	M	M	L	M	L	M	M	M	-	H	-	H	-
	CO4	H	H	M	H	H	H	H	H	M	H	-	H	-	H	-
BTCS15F3800	CO1	H	M	H	-	-	-	-	-	-	-	-	-	-	H	H
	CO2	H	H	-	-	H	-	-	-	H	-	-	-	-	-	-
	CO3	H	M	-	-	H	-	-	-	-	-	-	-	H	-	H
	CO4	H	H	-	-	-	-	-	-	H	-	-	-	-	H	-
BTCS15F4100	CO1	H	L	H	H	M	L	L	-	-	-	-	-	H	-	-
	CO2	H	H	M	M	M	L	H	-	-	-	-	-	H	-	-
	CO3	H	H	H	M	M	H	L	-	-	-	-	-	-	-	H
	CO4	M	M	M	M	H	M	L	-	-	-	-	-	H	H	H
BTCS15F4200	CO1	H	H	H	M	M	L	L	-	-	-	-	H	-	-	-
	CO2	H	H	H	M	H	L	H	-	-	-	-	H	H	-	-
	CO3	H	H	H	H	M	H	L	-	-	-	-	-	H	-	-
	CO4	H	H	H	M	H	H	L	-	-	-	-	-	-	H	-
BTCS15F4300	CO1	H	M	H	H	H	-	-	-	-	-	-		L	H	L
	CO2	M	H	L	M	M	-	-	-	-	-	-		H	H	H

	CO3	H	M	H	H	H	-	-	-	-	-	-		H	H	M
	CO4	M	H	L	H	M	-	-	-	-	-	-	L	L	-	H
BTCS15F4400	CO1	H	H	-	L	L	-	-	-	-	-	-	H	H	-	-
	CO2	H	H	H	H	M	-	-	-	H	H			H	H	-
	CO3	H	M	H	L	M	-	-	H	-	-			H	H	H
	CO4	H	M	M	M	M	-	-	-	-	H	-	-	H	-	H
BTCS15F4500	CO1	H	M	H	H	H	-	-	-	-	-	-	H	H	-	-
	CO2	M	H	L	M	M	-	-	-	H	H	-		H	-	H
	CO3	H	M	H	H	H	-	-	H	-	-	-		H	H	-
	CO4	M	H	L	H	M	-	-	-	-	H	-	-	H	-	-
BTCS15F4600	CO1	H	L	L	H	H	L	-	-	H	H	-	H	H	-	H
	CO2	M	H	H	H	H	-	-	H	-	-	-	H	H	H	-
	CO3	M	M	L	L	L	-	-	-	-	H	-	-	H	-	-
	CO4	M	L	L	L	L	-	-	-	H	H	-	-	H	-	H
BTCS15F4700	CO1	H	H	L	H	L	H	H	L	H	L	-	L	L	L	L
	CO2	M	M	-	M	H	M	M	H	M	H	-	H	M	H	M
	CO3	H	H	L	H	L	H	H	L	H	L	-	H	M	H	M
	CO4	M	L	-	H	H	M	L	H	H	H	-	H	L	H	L
BTCS15F4800	CO1	H	H	-	L	L	-	-	-	-	-	-	L	H	-	-
	CO2	H	H	L	H	H	-	-	-	-	H	L	H	H	-	L
	CO3	H	M	L	L	H	-	-	-	H	-	L	-	H	H	-
	CO4	H	M	H	H	H	-	-	H	-	-	-	-	H	H	L
BTCS15F5100	CO1	L	H	H	M	H	L	-	H	-	-	-	H	-	H	-
	CO2	H	M	L	H	H	M	-	-	-	H	-	-	H	H	-
	CO3	L	H	M	M	H	L	-	-	H	-	-	-	-	H	H
	CO4	M	L	M	H	H	L	-	-	-	-	-	-	-	H	-
BTCS15F5200	CO1	L	M	L	M	H	-	-	H	H	H	L	H	H	H	H
	CO2	H	M	H	L	L	-	-	H	H	H	L	H	H	H	L
	CO3	M	H	M	H	L	-	-	H	H	H	L	H	H	H	L
	CO4	M	M	L	L	H	-	-	H	H	H	L	H	H	H	H
BTCS15F5300	CO1	H	H	H	M	H	-	-	-	-	H		H	H	-	H
	CO2	H	H	M	H	L	-	-	-	-	-		H	H	-	H
	CO3	H	H	H	H	H	-	-	-	H	-		H	-	H	H
	CO4	H	H	M	H	L	-	-	H	-	H		H	-	H	H
BTCS15F5400	CO1	H	H	H	H	H	-	-	H	H	H	-	H	H	H	H
	CO2	H	H	H	M	H	-	-	-	-	H		H	H	-	H
	CO3	M	M	H	H	M	-	-	-	-	-		H	H	-	H
	CO4	H	H	L	M	L	-	-	-	H	-		H	-	H	H
BTCS15F5500	CO1	H	L	-	-	-	-	-	L	H	H	M	H	-	H	-
	CO2	H	H	H	H	-	M	-	H	H	H	M	H	H	H	-
	CO3	H	H	M	M	H	M	-	-	-	-	-	-	-	H	H
	CO4	M	H	M	H	H	L	-	-	-	-	-	-	-	H	-
BTCS15F5610	CO1	H	L	H	H	H	H	-	-	-	-	-	-	H	-	-
	CO2	H	H	H	H	H	H	-	-	-	-	-	-	H	-	-
	CO3	H	H	M	M	H	H	-	-	-	-	-	-	H	-	-
	CO4	M	H	M	H	H	L	-	-	-	-	-	-	H	-	-
BTCS15F5620	CO1	H	H	H	H	H	-	-	-	-	-	-	-	H	-	-
	CO2	H	H	H	H	H	L	-	-	-	-	-	-	H	H	-
	CO3	H	H	H	M	M	L	L	-	-	-	-	-	H	H	-
	CO4	H	H	H	H	M	-	-	-	L	-	-	-	H	H	-
BTCS15F5630	CO1	M	-	L	-	-	-	-	-	-	-	-	-	H	-	-
	CO2	-	L	-	-	M	-	-	-	-	-	-	-	H	-	-
	CO3	-	M	-	H	-	-	-	-	-	-	-	-	H	-	-
	CO4	M	L	H	-	-	-	-	-	-	-	-	-	H	-	-
BTCS15F5640	CO1	H	H			H	-	-	-	-	-	-	-	-	-	-
	CO2	H	H			H	-	-	-	-	-	-	-	-	-	-
	CO3	M	M			H	-	-	-	-	-	-	-	-	-	-
	CO4	M	M			H	-	-	-	-	-	-	-	-	-	-
BTCS15F5650	CO1	H	H	M	M	M		-	M	M	M	-	M	M	M	M
	CO2	H	H	H	M	M		-	H	M	M	-	H	M	M	M
	CO3	H	H	H	H	M		-	H	H	M	-	H	H	M	H

	CO4	H	H	M	H	H		-	M	H	H	-	M	H	H	H
BTCS15F5700	CO1	H	L	M	-	L	-	-	-	-	-	-	-	H	H	-
	CO2	H	M	H	M	L	-	-	-	-	-	-	-	H	H	-
	CO3	H	H	H	H	L	H	-	-	H	-	-	L	H	H	-
	CO4	H	M	M	L	H	-	-	-	L	H	-	-	H	H	-
BTCS15F5800	CO1	H	M	M	H	H	H	M	M	H	H	-	-	-	H	H
	CO2	H	M	M	H	H	H	M	M	H	H	-	-	-	H	H
	CO3	H	M	H	H	H	H	M	H	H	H	-	H	H	-	-
	CO4	H	H	M	H	H	H	H	M	H	H	-	-	-	H	H
BTCS15F6100	CO1	H	H	H	M	M	H	M	M	H	H	M	H	M	M	H
	CO2	H	H	H	H	H	H	M	M	H	H	L	H	M	M	H
	CO3	H	H	H	H	M	H	M	H	H	H	M	H	M	H	H
	CO4	H	H	H	M	M	H	H	M	H	H	L	H	H	M	H
BTCS15F6200	CO1	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
	CO2	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
	CO3	H	H	H	H	H	-	-	H	H	H	-	H	H	H	H
	CO4	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
BTCS15F6300	CO1	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
	CO2	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
	CO3	H	H	H	H	H	-	-	H	H	H	-	H	H	H	H
	CO4	H	H	H	H	M	-	-	H	H	M	-	H	H	M	H
BTCS15F6410	CO1	M	M	H	M	M	-	-	H	H	M	-	-	H	-	-
	CO2	M	H	M	M	M	-	-	H	H	M	-	H	H	-	-
	CO3	H	M	M	H	H	-	-	H	H	H	-	L	-	H	-
	CO4	M	M	M	M	M	-	-	H	H	M	-	L	-	-	H
BTCS15F6420	CO1	H	L	H	M	M	-	-	-	-	-	-	-	H	-	-
	CO2	M	M	M	H	L	-	-	-	-	-	-	-	H	-	-
	CO3	M	H	H	M	L	-	-	-	-	-	-	-	H	-	-
	CO4	H	H	L	M	L	-	-	-	-	-	-	-	H	-	-
BTCS15F6430	CO1	H	H	H	H	H	-	-	-	-	-	-	-	-	H	-
	CO2	H	H	H	H	H	-	-	H	-	H	-	-	-	H	-
	CO3	H	H	H	M	M	-	-	-	H	-	-	H	-	H	-
	CO4	H	H	H	H	M	-	-	-	-	-	-	-	-	H	-
BTCS15F6440	CO1	H	M	H	L	M	-	-	-	-	-	-	-	-	H	-
	CO2	H	H	H	M	M	L	-	-	-	-	-	-	-	H	-
	CO3	H	M	M	M	H	-	-	-	-	-	-	-	-	H	-
	CO4	H	H	H	M	M	M	-	-	-	-	-	-	-	H	-
BTCS15F6450	CO1	M	L	H	H	H	-	-	H	H	M	-	H	H	-	-
	CO2	H	H	H	H	L	-	-	H	H	M	-	-	H	-	H
	CO3	H	M	H	H	L	-	-	H	H	M	-	H	H	-	-
	CO4	H	H	H	H	H	-	-	H	H	H	-	L	H	H	-
BTCS15F6460	CO1	H	M	-	-	-	-	-	-	H	-	-	H	H	-	-
	CO2	M	M	-	L	H	-	-	-	M	-	-	M	H	-	-
	CO3	H	H	-	-	-	-	-	-		-	-	-	H	-	-
	CO4	H	H	-	M	-	-	-	-	H	-	-	-	H	-	H
BTCS15F6510	CO1	H	L	H	H	H	-	-	-	-	-	-	H	H	-	H
	CO2	H	H	H	H	H	-	-	-	-	H	-	-	H	-	-
	CO3	H	M	H	H	H	-	-	H	H	-	-	H	H	-	-
	CO4	H	H	H	H	H	-	-	-	-	-	-	-	H	H	H
BTCS15F6520	CO1	H	H	M	M	H	L	-	-	-	-	-	-	-	H	-
	CO2	H	M	H	H	H	L	-	-	-	-	-	-	-	H	-
	CO3	H	H	M	M	M	L	-	-	-	-	-	-	-	H	-
	CO4	M	H	M	H	H	L	-	-	-	-	-	-	-	H	-
BTCS15F6530	CO1	M	M	H	-	L	-	-	-	-	-	-	L	H	H	H
	CO2	M	L	L	M	H	-	-	-	-	-	-	-	-	H	H
	CO3	H	H	L	H	-	-	-	-	-	-	H	H	-	H	H
	CO4	M	L	H	M	H	-	-	-	-	H	-	-	-	H	H
BTCS15F6540	CO1	H	M	H	H	M	L	-	-	L	-	-	L	H	-	-
	CO2	H	H	H	H	M	M	-	-	L	-	-	L	H	-	-
	CO3	M	H	H	M	M	L	-	-	L	-	-	M	-	H	H
	CO4	H	M	H	M	M	L	-	-	L	-	-	L	H	-	-

BTCS15F6550	CO1	H	H	M	M	L	H	M	M	L	-	-	-	H	-	-
	CO2	H	H	M	M	H	H	M	M	H	-	-	-	H	-	-
	CO3	H	H	L	H	L	H	L	H	L	-	-	-	-	H	H
	CO4	H	H	H	H	H	H	H	H	H	-	-	H	H	H	-
BTCS15F6600	CO1	H	H	-	-	H	-	-	-	-	-	-	-	H	-	-
	CO2	H	H	-	-	H	-	H	-	-	-	H	-	H	-	-
	CO3	H	H	-	-	H	-	-	-	-	-	-	-	-	-	H
	CO4	H	H	-	-	H	-	-	-	-	-	-	H	H	-	-
BTCS15F7100	CO1	H	M	L	L	M	-	-	-	H	-	-	H	H	H	M
	CO2	H	M	L	L	M	-	-	H	-	-	-	-	H	H	M
	CO3	H	M	L	L	M	-	L	-	-	H	-	H	H	H	M
	CO4	H	H	H	H	H	H									
BTCS15F7310	CO1	H	H	M	L	-	-	-	L	-	H	-	-	H	H	-
	CO2	H	M	H	H	H	-	-	H	H	H	-	-	H	H	-
	CO3	H	M	M	L	H	-	-	L	H	H	-	H	H	H	-
	CO4	H	M	M	L	H	-	-	L	H	-	-	-	H	H	-
BTCS15F7320	CO1	H	L	L	L									H	H	H
	CO2	H	L	L	L									H	H	H
	CO3	H	M	M	L	-	-	-	-	-	-	-	-	H	H	H
	CO4	H	L	L	L	L	-	-	-	-	-	-	-	H	H	H
BTCS15F7330	CO1	H	M	M	L	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	H	M	H	-	-	-	-	-	-	-	H	H	H	H
	CO3	H	M	H	L	-	-	-	-	-	H	-	-	H	H	-
	CO4	H	M	M	L	-	-	-	-	-	-	-	H	H	H	H
BTCS15F7340	CO1	H	L	L	L	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	L	L	L	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	M	M	L	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	M	M	L	-	-	-	-	-	-	-	-	H	H	-
BTCS15F7350	CO1	H	-	M	M	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	-	M	L	H	-	-	-	-	-	-	-	H	H	H
	CO3	H	-	M	L	H	-	-	-	-	-	-	-	H	H	H
	CO4	H	-	M	M	H	-	-	-	-	-	-	-	H	H	H
BTCS15F7410	CO1	H	-	L	L	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	-	L	L	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	L	L	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	-	M	M	-	-	-	-	-	-	-	-	H	H	-
BTCS15F7420	CO1	H	-	L	-	-								H	H	-
	CO2	H	-	L	-	-								H	H	-
	CO3	H	-	L	-	-								H	H	-
	CO4	H	-	L	-	-								H	H	H
	CO5	H	-	L	-	H										
BTCS15F7430	CO1	H	-	L	-	-								H	H	-
	CO2	H	-	L	-	-								H	H	-
	CO3	H	-	M	H	-								H	H	-
	CO4	H	-	M	H	-								H	H	-
BTCS15F7440	CO1	H	H	M	-	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	H	H	-	H	-	-	-	-	-	-	-	H	H	H
	CO3	H	H	M	-	H	-	-	H	-	H	-	H	H	H	H
	CO4	H	H	M	H	H	-	-	-	H	-	-	-	H	H	H
BTCS15F7450	CO1	H	H	L	L	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	H	M	L	H	-	-	-	-	-	-	-	H	H	H
	CO3	H	H	M	L	H	-	-	-	-	-	-	-	H	H	H
	CO4	H	H	M	L	H	-	-	-	-	-	-	-	H	H	H
BTCS15F7510	CO1	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	M	-	M	-	-	-	-	-	-	-	H	H	H
	CO4	H	-	M	-	M	-	-	-	-	-	-	-	H	H	H
BTCS15F7520	CO1	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-

	CO4	H	-	M	-	M	-	-	-	-	-	-	-	H	H	-
BTCS15F7530	CO1	H	H	M	-	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	H	H	-	H	-	-	-	-	-	-	-	H	H	H
	CO3	H	H	M	-	H	-	-	H	-	H	-	H	H	H	H
	CO4	H	H	M	H	H	-	-	-	H	-	-	-	H	H	H
	CO5	H	H	M	-	H	-	-	-	-	-	-	-	H	H	H
BTCS15F7540	CO1	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	-	M	-	-	-	-	-	-	-	-	-	H	H	-
BTCS15F7600	CO1	H	H	M	L	H	-	-	-	-	-	-	-	H	H	-
	CO2	H	H	M	H	H	-	-	-	-	-	-	-	H	H	-
	CO3	H	H	H	L	H	-	-	-	-	-	-	-	H	H	-
	CO4	H	H	M	L	H	-	-	-	-	-	-	-	H	H	-
BTCS15F7700	CO1	H	H	M	L	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	H	M	H	H	-	-	-	-	-	-	-	H	H	H
	CO3	H	H	H	L	H	-	-	-	-	-	-	H	H	H	H
	CO4	H	H	M	L	H	-	-	-	-	-	-	-	H	H	H
BTCS15F8110	CO1	H	H	-	H	-	-	-	-	-	H	-	-	H	H	-
	CO2	H	-	-	-	-	-	-	H	-	-	-	H	H	H	-
	CO3	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	-	-	-	-	-	-	-	H	-	-	-	H	H	H
BTCS15F8120	CO1	H	-	L	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	-	L	-	-	-	-	-	-	-	-	-	H	H	-
	CO5	H	-	M	-	-	-	-	-	-	-	-	-	H	H	-
	CO6	H	-	M	-	-	-	-	-	-	-	-	-	H	H	-
BTCS15F8130	CO1	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	M	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	-	M	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	-	M	-	-	-	-	-	-	-	-	-	H	H	-
BTCS15F8140	CO1		H	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2		H	H	-	H	-	-	-	-	-	H	-	H	H	H
	CO3		H	H	-	H	-	-	-	-	-	-	H	H	H	H
	CO4		H	H	-	H	-	-	-	-	H	-	-	H	H	H
BTCS15F8140	CO1	-	-	-	-	-	-	-	-	-	-	-	H	H	H	-
	CO2	-	H	H	-	H	-	-	-	-	-	H	-	H	H	-
	CO3	-	-	L	-	-	-	-	-	-	H	-	-	H	H	-
	CO4	-	-	H	-	-	-	-	-	-	-	-	-	H	H	-
BTCS15F8160	CO1	H	M	L	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	M	L	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	M	L	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	M	L	L	-	-	-	-	-	-	-	-	H	H	-
BTCS15F8210	CO1	H	M	-	-	H	-	-	-	-	-	-	-	H	H	H
	CO2	H	M	M	L	H	-	-	-	H	-	-	-	H	H	H
	CO3	H	H	H	H	H	-	-	H	-	-	-	-	H	H	H
	CO4	H	M	M	L	H	-	-	-	-	H	-	H	H	H	H
BTCS15F8220	CO1	H	H	M	L	L	-	-	-	-	-	-	-	H	H	-
	CO2	H	H	M	L	L	-	-	-	-	-	-	-	H	H	-
	CO3	H	H	M	L	L	-	-	-	-	-	-	-	H	H	-
	CO4	H	H	M	L	L	-	-	-	-	-	-	-	H	H	-
BTCS15F8230	CO1	H	-	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO2	H	L	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO3	H	L	-	-	-	-	-	-	-	-	-	-	H	H	-
	CO4	H	L	-	-	-	-	-	-	-	-	-	-	H	H	-
BTCS15F8240	CO1	H	-	-	-	-	-	-	-	-	L	-	L	H	H	-
	CO2	H	-	-	-	-	-	-	-	-	-	-	L	H	H	-
	CO3	H	-	L	-	-	-	-	-	-	-	-	L	H	H	-
	CO4	H	-	L	-	-	-	-	-	-	L	L	L	H	H	-
BTCS15F8250	CO1	H	H	M	-	H	H	-	-	-	-	-	-	H	H	H

	CO2	H	H	M	-	H	H	-	-	-	-	-	-	H	H	H
	CO3	H	-	H	-	H	H	-	-	-	-	-	-	H	H	H
	CO4	H	H	M	-	H	-	-	-	-	-	-	-	H	H	H

I YEAR DETAILED SYLLABUS

I SEMESTER SYLLABUS

FIRST SEMESTER:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEM15F1100	Engineering Mathematics – I	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. To understand the concepts of differential calculus and its applications.
2. To familiarize with partial differentiation and its applications in various fields.
3. To familiarize with exact differential equations and different solving techniques.
4. To familiarize with concept of Integral calculus and its applications.

COURSE OUTCOMES:

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

1. Find higher order derivatives for a function of single and multiple values.
2. Expand function in ascending powers of x about origin and about the given point.
3. Find the pedal equation for a polar curve and angle between the polar curves.
4. Identify and solve exact differential equations.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT-I: Differential Calculus-I

Successive differentiation-nth derivatives (proof and problems), Leibnitz Theorem (without proof) and problems, Taylors series and Maclaurins series expansion for one variable (only problems), Polar curves- Angle between the radius vector and tangent, angle between two curves, Pedal equation for polar curves.

UNIT-II: Differential Calculus-II

Derivative of arc length – concept and formulae without proof, Radius of curvature-Cartesian, parametric, polar and pedal forms (without proof) problems. Indeterminate forms and solution using Hospital's rule.

Partial Differentiation: Partial derivatives-Euler's theorem-problems, Total derivative and chain rule.

UNIT-III: Differential Calculus-III and Differential Equations

Jacobians-definition and problems (only find *J* and*reference- one example on $JJ^{/}$=1). Taylor's Expansion of function of two variables (only problems- up to 2nd order). Maxima and Minima for a function of two variables (simple problems). Exact equation and reducible to exact form (1.Close to expression M or N and find IF, 2. y f(x) dx+x g(y) dy)

UNIT-IV: Integral Calculus

Reduction formulae for the integrals of $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$ and evaluation of these integrals with standard limits(direct result) -Problems. Multiple Integrals – Double integrals, change of order of integration (simple problems), and triple integrals. Beta and Gamma functions (definition), (properties and duplication formula -without proof), Relation between beta and gamma function and simple problems.

REFERENCES:

1. B.V.Ramana,"Higher Engineering Mathematics",Tata McGraw Hill Publications,19th Reprint edition,2013.
2. R.K.JainandS.R.K.Iyengar,"Advanced Engineering Mathematics",Narosa Publishing House,4thedition,2014.

RECOMMENDED LEARNING RESOURCES:

1. B.S.Grewal,"Higher Engineering Mathematics",Khanna Publishers,43nd edition,2015.
2. Erwin Kreyszig,"Advanced Engineering Mathematics",Wiley Publications,9th edition,2013.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEP15F1200	Engineering Physics	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. Apply the knowledge of differential calculus in the field of wave theory and communication systems.
2. Apply the knowledge of Differential Equations in the field of Engineering.
3. Analyze and implement the concepts of Divergence and curl of vectors which play significant roles in finding the Area and volume of the closed surfaces.
4. Apply the knowledge of convergence of the series, which help in forming JPEG image compression.
5. To determine whether a sequence or a series is convergent or divergent and evaluate the limit of a convergent sequence or the sum of a convergent series.

COURSE OUTCOMES:

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

1. Apply knowledge of physics to different systems and analyze different problems.
2. Understand the need of quantum mechanics and its importance and applications.
3. Get the knowledge to explain electrical conductivity of materials.
4. Get exposed to recent trends in nanoscience and technology.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Wave mechanics: Introduction to Wave mechanics, Wave particle dualism. De-Broglie hypothesis, Matter waves and their characteristic properties. 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. Relation between group velocity and particle velocity, Expression for de-Broglie wavelength using the concept of group velocity. Heisenberg's uncertainty principle, its significance and its applications (nonexistence of electron inside the nucleus). 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. Numerical.

UNIT - II:

Lasers and optical fibers: 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, Construction and working of Carbon Dioxide (CO_2) laser &semiconductor laser. Applications: Holography (recording and reconstruction of images) and its applications, Numerical.

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). Advantages and limitations of optical communications, Numerical.

UNIT - III:

Electrical properties of conductors and superconductors: Electrical Conductivity in Metals, Drude Lorentz classical free electron theory, drift velocity, mean free path, mean collision time and relaxation time. Expression for electrical conductivity in metals, Effect of impurity and temperature on electrical resistivity in metals, Failures of classical free electron theory. Quantum free electron theory, Fermi- Dirac statistics, Fermi level, Fermi energy and Fermi factor, Variation of Fermi factor with energy and temperature, Density of states (qualitative explanation), effective mass, Merits of Quantum free electron theory, Numerical.

Superconductors: Temperature dependence of resistivity in superconductors, variation of critical field with temperature, Properties of superconductors (Isotope effect, Meissner effect, Silsbee effect), Types of superconductors, BCS theory, Applications of super conductors, Maglev vehicle and super conducting magnet.

UNIT - IV:

Ultrasonic, Dielectric and Nanomaterials: **Ultrasonic:** Production of ultrasonic by piezoelectric method, Measurement of velocity of ultrasonic in solid and liquid, Non-destructive testing of materials using ultrasonic.

Dielectric materials: Electric dipole and dipole moment, electric polarization (P), dielectric susceptibility (χ_e),dielectric constant, relation between χ and P, Electrical polarization mechanisms(electronic, ionic, orientation, space charge polarization), Expression for internal field in one- dimensional solid dielectrics, Ferro, Piezo andPyroelectric materials–their properties and applications, Numerical.

Nanomaterials: Introduction to nanoscience, nanomaterials and their applications, Synthesis of Nano materials using bottom-up method (arc method), top-down methods (ball milling method), Carbon Nanotubes: properties and applications.

REFERENCES:

1. Laser Fundamentals,WilliamT.S ilfvast,2nd Edition,Cambridge University press,New York(2004).
2. Fundamentals of Physics,6th Edition,D.Halliday,R.Resnickand J.Walker,John Wiley and Sons,New York(2001).
3. Introduction to Solid State Physics,7th Edition Charls Kittel,Wiley,Delhi(2007).
4. Arthur Beiser,Concepts of modern Physics,Tata Mc Graw Hill publications,New Delhi.

RECOMMENDED LEARNING RESOURCES:

1. Engineering Physics, R.K Gaur and S.L. Gupta, DhanpatRai Publications (P) Ltd, NewDelhi.
2. A text book of Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, NewDelhi.
3. Solid State Physics, S.O. Pillai, New Age International publishers, NewDelhi.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCV15F1300	Elements of Civil Engineering	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. To enable students to establish a broad concept of engineering mechanics.
2. To enable students to understand the basics of composition of coplanar forces.
3. To enable students to understand the concept of equilibrium of coplanar forces.
4. To provide an overview of centroid of plane area & moment of Inertia of plane area.

COURSE OUTCOMES:

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

1. Describe the moment of force and couples and equivalent force-couple system.
2. Solve numerical problems on composition of coplanar concurrent and non-concurrent force system.
3. Solve numerical problems on equilibrium of coplanar force system.
4. Locate the centroid and moment of inertia of different geometry.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT - I:

Introduction to Basic Civil Engineering: Scope of civil engineering, role of civil engineer, branches of civil engineering (brief discussion 2 to 3 hours only).

Engineering mechanics: Basic idealizations - Particle, Continuum and Rigid body; Force and its characteristics, types of forces, Classification of force systems; Principle of physical independence of forces, Principle of superposition of forces, Principle of transmissibility of forces; Newton's laws of motion, Introduction to SI UNIT - s, Moment of a force, couple, moment of a couple, characteristics of couple, Equivalent force - couple system,

Resolution of forces, composition of forces; Numerical problems on moment of forces and couples and equivalent force - couple system.

UNIT - II:

Analysis of Force Systems: Composition of forces - Definition of Resultant, Composition of coplanar - concurrent force system, Parallelogram Law of forces, Principle of resolved parts, Numerical problem son composition of coplanar concurrent force systems, Composition of coplanar - non-concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar concurrent force systems.

UNIT – III:

Equilibrium of coplanar forces: Definition of static equilibrium and Equilibrant, Conditions of static equilibrium for different coplanar force systems, Lami's theorem, Concept of Free Body Diagram, Numerical problems on equilibrium of coplanar – concurrent and non-concurrent force systems.

UNIT – IV:

Centroid and Moment of Inertia Centroid: Introduction to the concept, Centroid of plane figures, Locating the centroid of triangle, semicircle, quadrant of a circle and sector of a circle using method of integration, Centroid of composite sections; Numerical problems.

Moment of Inertia: Introduction to the concept, Rectangular and polar moment of inertia, Radius of gyration, Perpendicular axis theorem and Parallel axis theorem, Moment of Inertia of rectangle, circle, semi-circle, quarter circle and triangle from method of integration, Moment of inertia of composite areas, Numerical problems.

REFERENCES:

1. S. Timoshenko, D.H. Young and J.V. Rao, “Engineering Mechanics”, TATA McGraw-Hill Book Company, NewDelhi
2. Beer FP and Johnston ER, “Mechanics for Engineers- Dynamics and Statics”, 3rd SI Metric edition, Tata McGraw Hill. -2008
3. ShamesIH,“EngineeringMechanics–Statics&Dynamics”,PHI–2009.

RECOMMENDED LEARNING RESOURCES:

1. M.N.Shesha Prakash and Ganesh B.Mogaveer,“Elements of Civil Engineering and Engineering Mechanics”, PHI Learning, 3rd Revised edition
2. A.Nelson,“Engineering Mechanics-Statics and Dynamics”,TataMcGraw-Hill Education Private Ltd, New Delhi,2009
3. S. S. Bhavikatti, “Elements of Civil Engineering”, New Age International Publisher, New Delhi, 3rd edition2009.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTME15F1400	Elements of Mechanical Engineering	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. To develop the basic knowledge of working of various turbines and ICengines.
2. To incorporate the concepts of metal joining process, their applications and power transmission modes like belt drives, gears and gear trains.
3. To understand various mechanical machines and operations.
4. Introduce about lubrication and its importance.
5. To understand basic power transmission concepts.

COURSE OUTCOMES:

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

1. Apply the concepts of working principle of turbines in the power plants and also of the IC engines in the basic design of the vehicles.
2. Have a basic knowledge of metal joining and power transmission and apply them in some basic requirements.
3. Gain the knowledge about machine tools, cutting operations, belt and gear drive power transmission.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Properties of steam: Introduction**,** Steam formation, Types of steam. Steam properties, Specific Volume, Enthalpy and Internal energy, Steam table and simple numerical problems

Steam Generators – classification, Lancashire boiler, Babcock and Wilcox boiler, Boiler mountings, accessories and applications

Turbines- Introduction to turbines & prime movers, Classification of turbines, Working principle and applications of impulse and reaction steam turbines, gas turbines (open and closed cycle type) and water turbines (Pelton wheel, Francis and Kaplan), Compounding of impulse turbine.

UNIT - II:

Internal Combustion Engines : Introduction, Classification of IC engines, parts of IC engine, Working principle of four stroke (petrol and diesel) and two stroke petrol engines, differences between 4 Stroke & 2 Stroke engines and petrol & diesel engines, Numerical problems on power and efficiencies.

Refrigeration and Air conditioning- Introduction, Principle of refrigeration, parts of refrigerator, Principle and working of vapor compression refrigeration and vapor absorption refrigeration. Refrigerants, Properties of refrigerants, Refrigerating effect, Ton of Refrigeration, COP, Relative COP, UNIT - of Refrigeration, Principle and applications of Room air conditioners.

UNIT – III:

Machine Tools: Introduction, working principle and classification of lathe, drilling and milling machines, major parts of a lathe and their functions, lathe operations on lathe - Specifications of lathe, parts of radial drilling machines, drilling operations, parts of horizontal milling machines, milling operations.

Metal joining processes- Introduction, classification of metal joining processes, method of welding (Electric Arc welding), soldering and brazing and their differences.

UNIT - IV:

Lubrication: Necessity, types of lubrications, properties of good lubricant.

Bearings- Classification and application of bearings only.

Power Transmission- Introduction to transmission systems and its classification, types of Belt Drives**,** Definitions of Velocity ratio, angle of contact Creep and slip, Idler pulley, stepped pulley, fast & loose pulley, simple problems.

Gears - Definitions, Spur gear terminology, Types and applications of Gears.

Gear Trains – Simple and compound gear trains, Simple problems on gear trains

REFERENCES:

1. The Elements of Workshop Technology - Vol I & II , SKH Chowdhary, AKH Chowdhary , Nirjhar Roy, 11th edition 2001, Media Promotors and Publishers, Mumbai.

RECOMMENDED LEARNING RESOURCES:

1. A Text Book of Elements of Mechanical Engineering–K.R.Gopalkrishna,Subhash Publishers, Bangalore.

2. Elements of Mechanical Engineering – Kestoor Praveen and M.R. Ramesh 2nd Edition 2011, Suggi Publications.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEE15F1500	Basic Electrical Engineering	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The Objectives of this course are to:

1. To explain the basic of Electrical and Electronics Engineering terminologies.
2. To make students understand the principal operation of Electrical Machines.
3. To provide an insight into various sources of power generation.
4. To introduce the concept of domestic wiring and importance of safety and sensing devices.

COURSE OUTCOMES:

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

1. Outline the basics of Electrical engineering terminologies and usage.
2. Describe the principle of operation of electrical machines.
3. Outline the generation of different types of Power Generation.
4. Relate the applications of electronic devices and sensors in practical life.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	3	-	-	-	-	-	-	-	-	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	1	-	-	-	-	2	-	-	3	-	-
CO4	3	3	3	3	1	-	-	-	-	-	-	-	-	-	-

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

COURSE CONTENTS:

UNIT – I:

Introduction to Electrical Parameters: Concept of Alternating Voltage and Current, Sinusoidal functions-specifications, Phasor representation, concept of impedance, admittance, conductance and susceptance–series and parallel circuits of RLC. Concept of power and power factor. Kirchoff's laws and network solutions. Electromagnetic induction-laws, direction & magnitude of indused emf, mmf, permeability, reluctance and comparison of electric and magnetic circuits. Self and mutual inductance of a coil, coupling coefficients. Concept of energy storage in L &C, resonance between L &C. Generation of three phase voltages, star-Wye configurations, relation between line and phase quantities and expression for power.

UNIT – II:

Electrical Apparatus: DC generator, DC motor-concept of force, torque and mechanical work. Single and three phase induction motors, shaded pole motor, universal motor, stepper motor: Basic construction, principle of operation and applications. Single and three-phase transformers: Principle, emf equation.

UNIT –III:

Generation & Distribution: Block diagram representation of generation, transmission and distribution. Current generation and transmission scenario, need for transmission at high voltage. Block diagram representation of

thermal, hydel, nuclear, diesel and renewable power plants. Concept of smart-grid and role of ICT in smart-grid.

UNIT – IV:

Tariff, Protective Devices and Sensors: Tariff schemes, basic concepts of domestic wiring and types, earthing, protective fuses, MCB. Sensors: pressure sensor, strain gage, proximity sensor, displacement sensor, rotary encoder and ultrasonic sensors (applications in relevant disciplines- ref to 8 and 9)

Recommended Learning Resources:

1. Theodore Wildi,"Electrical Machines, Drives, and Power, 5th Systems",Pearson Edition,2007
2. Hughes,"ElectricalTechnology",InternationalStudents9th Edition,Pearson,2005
3. KulshreshthaC,"Basic Electrical Engineering"Tata McGraw Hill, 2nd Edition,2011
4. MittleV.N.andA.Mittal,"BasicElectricalEngineering"TataMcGrawHill,2nd Edition,2005
5. Kothari D.P., L.J. Nagrath"Basic Electrical Engineering",Tata McGraw Hill,2009
6. Robert L. Boylestad and Louis Nashelsky, "Introduction to Electricicty, Electronics and Electromagnetics"Prentice Hall,5th edition,2001
7. Introduction to smart grid:http://www.occ.ohio.gov/publications/electric/Smart_Grid_An_Introduction.pdf
8. Role of ICT in smart grid:http://users.atlantis.ugent.be/cdvelder/papers/2010/develder2010sgc.pdf
9. Sensors:http://www.omron-ap.co.in/technical_guide/
10. Strain gage with bridge circuit:http://www.facstaff.bucknell.edu/mastascu/elessonshtml/Sensors/StrainGage.htm#SensorsInVoltageDivider Circuits

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTIC15F1600	Indian Constitution and Professional Ethics	16	FC	1	1	0	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide and gain knowledge on Constitution of India.
2. Know and understand about the Fundamental Rights, Duties and other Rights which is been given by our law.
3. Prepare students in the praticality of Constitution perspective and make them face the world as a bonafide citizen.
4. Attain knowledge about ethics and also know about profession alethics.
5. Explore ethical standards followed by different companies.

COURSE OUTCOMES:

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

1. Strengthen the knowledge on Indian constitutional law and make the practical implementation of it.
2. Understand the fundamental rights and human rights.
3. Get the knowledge to explain the duties and more importantly practice it in a right way.
4. Adopt the habit of raising their voice against an on constitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	3	1	-	3	2	3	3	-	2	1	3	1	-
CO2	1	3	2	2	-	3	2	3	3	-	2	3	2	2	-
CO3	2	2	2	2	-	3	2	3	1	-	2	2	2	2	-
CO4	3	3	3	3	-	3	2	3	1	-	2	3	3	3	-

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

COURSE CONTENTS:

UNIT – I:

Constitution of India : Definition, Making of Indian Constitution, Preamble to the Constitution of India, Fundamental Rights under Part III; Rights to Equality, Right to Freedom, Right against Exploitation, Rights to

Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Characteristics. Elements of National Significance; National Flag, National Anthem, NationalEmblem.

UNIT – II:

Union and State: Organs of the Government; Legislature, Executive and Judiciary. Union and State Executives: President, Vice President, Prime Minister, Supreme Court, Cabinet, Governor, Councill of Ministers, Electoral process, Election Commission. Right to Information (RTI), Consumer and Consumer Protection.

UNIT – III:

Ethics: Meaning, Definition, Evolution, Need of ethics, Aristotlean Ethics, Utilitarianism, Katianism, Professional Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

UNIT – IV:

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

RECOMMENDED LEARNING RESOURCES:

1. M V Pylee, An introduction to Constitution of India
2. M Govindarajan, S Natarajan, V S Senthil Kumar, Engineering

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCE15F1700	Technical English – I	16	FC	1	1	0	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. To prepare and mould students to face the global corporate world and help to overcome technical glitches in the deployment of language.
2. To understand the linguistic dimension of our existence and to learn the fundamental organizing principle of language.
3. To know the strength, flexibility, and variety of our language, and thus be in a better position to use it and to evaluate others' use of it.
4. To attune young minds to concerns and issues which have a broad and wide scope of use and application to life.
5. To cut across the history of creative expression in focusing primarily on the core values that governs human lives.

COURSE OUTCOMES:

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

1. To use the target language effectively focusing on interpersonal skills and a lot of other things and to develop good command over the language and possess excellent communication skills.
2. To understand the linguistic dimension of our existence and to learn the fundamental organizing principle of language and to know the strength, flexibility, and variety of our language, and thus be in a better position to use it and to evaluate others' use of it.
3. Acquiring new vocabulary and content words along with the analytical skill. The power of comprehension can be promoted through reading and listening.
4. Able to communicate clearly and effectively – orally, visually and in writing. They will learn to recognize,adapt and use their skills confidently and effectively in different situations and contexts.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	3	1	-	3	2	3	3	-	2	1	3	1	-
CO2	1	3	2	2	-	3	2	3	3	-	2	3	2	2	-
CO3	2	2	2	2	-	3	2	3	1	-	2	2	2	2	-
CO4	3	3	3	3	-	3	2	3	1	-	2	3	3	3	-

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

COURSE CONTENTS:

Unit-I:

Communicative Skills & Functional English: Basics of Communication, Verbal & Non-verbal Communication, Barriers to Effective Communication, Strategies of Effective Communication, Tenses, Conditional Sentences, Auxiliaries (Modal & Primary)

Unit-II:

Listening & Reading Skills: Definitions (Listening & Reading), Types of Listening, Barriers to Effective Listening, Traits of a Good Listener, Types of Reading, Techniques of Effective, Reading Tasks (Critical & Inferential Reading

Unit –III:

Academic Writing – I: Paragraphs, Notice/ Agenda/ Minutes, Note Taking/ Note Making, Summarizing, Project Reports.

Unit- IV:

ICT/ Digital/ E-Skills: Computer Assisted Language Learning (CALL), Mobile Assisted Language Learning (MALL), Emails, Blogs, Digital/ E-Portfolio, Filling Online Application Forms.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTPL15F1800	Engineering Physics Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Make the students gain practical knowledge of Physics to co-relate with the the oretical studies.
2. Provide students with a theoretical and practical knowledge of Physics.
3. Achieve perfectness in experimental Skills and the study of practical applications improve confidence and ability to develop and fabricate engineering and technical equipments.
4. Provide the idea of basic electronic circuits, optical instruments and will be able to carry out experiments in optics and verify other important laws of Physics.

COURSE OUTCOMES:

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

1. Develop skills to apply practical knowledge of Physics in real time solution.
2. To understand and verify different laws of Physics using some simple experiments.
3. To design simple electrical circuits and analyze obtained result.
4. Ability to apply knowledge of basic electronics in making simple circuits using diodes and transistors and analyze the responses.

CO PO & PSO MAPPING:

POs/ COs	PO1	PO2	PO3	PO4	PO5	P O6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	2	-	-	3	3	2	2	-	3	-
CO2	2	2	-	-	-	2	-	-	3	3	2	2	-	3	-
CO3	2	2	-	-	-	2	-	-	2	2	2	2	-	3	-
CO4	2	2	-	-	-	2	-	-	2	2	2	2	-	3	-

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

LAB EXPERIMENTS:

1. Determination of wavelength of the given laser using diffraction grating.
2. I-V characteristics of Zener-diode – (determination of knee voltage breakdown voltage and forward resistance).
3. Determination of Planck's constant using LED.
4. Determination of energy gap of a semi- conductor.

5. Measurement of dielectric constant by charging and discharging method.
6. I-V characteristics of NPN-Transistor in C-E mode. (Determination of knee voltage input resistance, output resistance, current gain and current amplification factor breakdown).
7. Photo diode characteristics (I-V characteristics in reverse bias, variation of photocurrent as a function of intensity and reverse voltage).
8. Determination of Young's modulus of the material by single cantilever method/uniform bending method.
9. Determination of resonant frequency, band width and quality factor of the given LCR series and parallel resonance circuits.
10. Determination of rigidity modulus of the material and moment of inertia of an irregular body using Torsional pendulum.
11. Measurement of numerical aperture and attenuation in optical fibers. (DemoExpt.)
12. Determination of electrical resistivity by four probe method. (Demoexpt.)
13. Measurement of velocity of ultrasonics in the given liquid-acoustic grating method. (Demo Expt.)

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEW15F1900	Basic Electrical Engineering Lab	16	HC	1	0	1	2	3

This course will be evaluated by Electrical and Mechanical faculty.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Establish a broad concept of various types of electrical apparatus and instrumentation.
2. Provide hands on experience with electrical apparatus.
3. Train students to read and understand schematics so as to make connection.
4. Train students in collecting and interpreting experimental data.
5. Enhance written skills of students.

COURSE OUTCOMES:

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

1. Recognize various symbols in a schematic and make connection as per the schematic.
2. Systematically follow various safety procedures.
3. Make use of various measuring instruments to collect experimental data.
4. Relate experimental results with theoretical analysis.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	-	1	2	-	-	-	-	3	-	-	-	-	-	-
CO2	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	2	2	1	-	-	-	-	-	-	-	-	-	-	-

LAB EXPERIMENTS:

1. Electrical tool introduction

(i) Electrical Tools

ii)Measuring Instruments like Ammeter, Voltmeter, Multi-meter, Clamp on meter, Energy meter, Watt meter (UPF & LPF)

2. Home electrical wiring demonstration:

(i) Tube light wiring

(ii) Fan wiring

(iii) Two way control

(iv) Socket to switch connection.

(v) Electrical wiring materials & accessories

3. Study of mutual induction effect.

4. Electrical safety training:

(i) Electrical activities to avoid shocks and importance of earthing.

(ii)Working of MCB, ELCB

(iii) Role of fuse.

5. Home electrical wiring demonstration: short circuit, series and parallel operation of load.

6. Single phase transformer: polarity tests.

7. Diode rectifier applications: Half wave and Full wave rectifier, ripple factor calculations.

8. Sensor experiments: Pressure sensor, light sensor and temperature sensor.

9. DC Machine demonstration.

II Semester Syllabus

SECOND SEMESTER:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEM15F2100	Engineering Mathematics – II	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

1. To understand the concepts of Linear algebra and its applications in various fields of engineering and Technology.
2. To understand the concepts of Integral calculus and its applications.
3. To familiarize with partial differential equations, and its applications to standard problems like Heat, Wave and Laplace.
4. To impart the Knowledge of Laplace transforms and its applications in the field of engineering.

COURSE OUTCOMES:

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

1. Apply the knowledge of Linear Algebra in Image processing and digital signal processing.
2. Apply the knowledge of Integral calculus to perform integration and other operations for certain types of functions and carry out the computation fluently.
3. Apply the knowledge of partial differential equations in the field of signals and systems, control systems, magnetic wave theory.
4. Apply the knowledge of Laplace transformation from the time domain to the frequency domain, which transforms differential equations into algebraic equations and convolution into multiplication.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-	-

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

COURSE CONTENTS:

UNIT-I: Linear Algebra

Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector.LU decomposition,

Linear and Inverse transformation.

Diagonalization of a matrix, Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT-II:

Differential Equations:

Linear Differential Equations: Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral.

Method of variation of parameters (simple problems), Cauchy's and Legendre's linear differential equations.

Partial differential equation: Formation of Partial differential equations, Solution of Lagranges linear PDE.

UNIT-III: Vector Calculus

Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields.

Vector identities-div( ), curl( ), curl(grad), div(curl*A*).Line integral-Circulation-work, Surface integral: Green's Theorem, Stokes Theorem. Volume integral: Divergence theorem.(all theorems without proof, no verification, only evaluation).

UNIT-IV: Laplace Transforms:

Definition, Transforms of elementary functions, properties of Laplace Transforms (without proof) problems. Transforms of periodic functions (only statement and problems), Unit step functions and unit impulse functions.

Inverse Laplace transforms- Problems, convolution theorem (without proof) - verification and problems, solution of linear differential equation using Laplace transforms.

REFERENCES:

1 B.V.Ramana,"Higher Engineering Mathematics",TataMcGraw Hill Publications,19th Reprint edition, 2013.

2 R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition,2014.

RECOMMENDED LEARNING RESOURCES:

1 B.S.Grewal,"Higher Engineering Mathematics",Khanna Publishers,43nd edition,2015.

2 Erwin Kreyszig,"Advanced Engineering Mathematics",Wiley Publications,9th edition, 2013.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEC15F2200	Engineering Chemistry	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

Engineering chemistry covers the very basic knowledge required for engineering students to understand its importance in technology. All the branches directly or indirectly deal with the principles of chemistry, for example;

1. Cell and Batteries deals with basic principles, types of electrodes and their importance in some applications and materials required for designing and proper functioning of batteries.
2. Corrosion and metal finishing, explains why and how materials corrode 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.

COURSE OUTCOMES:

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

1. The importance of electrodes and materials in designing a battery.
2. Corrosion phenomenon and precautions to be taken in the selection of materials in controlling corrosion.
3. Fabrication of PCB, an important component for electronic industries.
4. Properties of polymers and their applications in various field, also that of composite materials in sports, aviation etc.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	3	2	2	2	2	-	-	-	-	-	-	-	-
CO3	2	2	3	3	1	2	1	-	-	-	-	-	-	-	-
CO4	3	3	2	2	2	1	2	-	-	-	-	-	3	-	-

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

COURSE CONTENTS:

UNIT –I:

Cells and Batteries: Introduction to electrochemistry, Basic concepts, Battery characteristics –primary, secondary and reserve batteries, Super capacitors, Lithium batteries. Fuel cells-Difference between battery and

fuel cell, types of fuel cells- construction working, applications, advantages& limitations of Solid oxide fuel cells and phosphoric acid fuel cell. Photovoltaic cell-Production of single crystal semiconductor by Crystal pulling technique (Czocharlski method), zone refining of si, antireflective coatings, Construction and working of photovoltaic cells and its applications and advantages using elemental si and semiconductors.

UNIT – II:

Corrosion & its control & metal finishing: Introduction to Electrochemical theory of corrosion, Galvanic series Types of Corrosion- Differential metal corrosion Differential aeration corrosion(Pitting & water line),Stress corrosion (Caustic embrittlement), and Grain boundary corrosion, Factors affecting rate of corrosion-Primary, secondary, pilling bed worth role, Energy concept (Pour biax) under different pH conditions. Corrosion Studies on Al, Fe with phase diagram Corrosion control: Inorganic coating - Anodizing &Phosphating, metal coating-galivanzing & tinning, cathodic protection, Anodic Protection. Role of secondary reference electrode in corrosion studies (calomel ,Ag/AgCl)

Metal Finishing-Technological importance, significances of polarization. Decomposition potential & overvoltage in electroplating, theory of electroplating. Effect of plating variables on the nature of electrodeposit-electroplating process, Electroplating of gold, Introduction to Electro less plating-Cu.

UNIT – III:

Introduction to Nano science and Nanotechnology: Introduction to Nanomaterials, Properties –optical, electrical, magnetic and thermal. Chemical synthesis of Nanomaterials – sol gel (MOx NPs), phase transfer method (Au NPs). Carbon Nanomaterials-Fullerenes, graphene, CNT. Applications of Nano materials- Nano catalysis, Nano-electronics, energy conversion materials (in batteries, solar cells), nano sensors. Introduction to electromagnetic spectrum-material analysis, Instrumentation-principle, working and applications of UV-Visible, XRD,SEM.

UNIT – IV:

Polymers: Introduction, Types of polymerization-Addition and Condensation, Ziegler's Natta catalyst, molecular weight determination by viscosity method, glass transition temperature, Structure and Property relationship. Synthesis &Applications of -Bakelite, ABS, Nylon6,6, PMMA.

Adhesives-Synthesis and applications of epoxy resins, Polymer composites- Synthesis and applications of Kevlar and Carbon fibers, Conducting polymers-Definition, Mechanism of conduction in polyacetylene , Synthesis & applications of conducting Polyaniline, Polymer liquid crystals, Biopolymers, Polymer membranes-ion exchange &ionic conductivity.

RECOMMENDED LEARNING RESOURCES:

1. Engineering chemistry by R.V. Gadag and Nithyanandashetty, IkInteranational Pudlishing house
2. Engineering chemistry by R.Venugopal, Pushpaiyengar, B.S. Jayaprakash and Shiva kumariah Subhash Publications
3. Polymer chemistry by V.R. Gowrikar, N.N. Vishwanathan and J. Sreedhar by Wiley eastern ltd.
4. Corrosion engineering by M.G. Fontana, Tata Mcgrahill Publishing pvt.Ltd
5. Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens Wiley India Publishers.
6. Theory and practice in applied chemistry by O.P. Vermani and Narulla, New age international publications
7. Vogel's textbook of quantitative chemical analysis by G.H.Jeffery,J.Bassett,J.Mendham and R.C. Denney.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTEC15F2300	Basic Electronics Engineering	16	HC	3	0	0	3	4

COURSE OBJECTIVES:

1. To familiarize with the number systems, Boolean algebra and digital circuit design.
2. To understand the diode characteristics and its applications.
3. To learn the working principles of various electronic circuits.
4. To understand the transistor characteristics and its applications.
5. To compare the different biasing methods of transistors.
6. To understand the working of amplifiers and communication systems.
7. To understand the power electronic devices.

COURSE OUTCOMES:

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

1. Design the digital circuits using various logic gates. Analyze various diode circuits.
2. Work on various application based on electronic instruments. Design of amplifier circuitbased on BJT.
3. Demonstrate the working of amplifiers and the oscillators.
4. Analyze the various communication techniques and study of op-amp's.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	-	-	3	2	3
CO2	3	3	2	-	2	-	-	-	-	-	-	-	3	3	3
CO3	3	2	3	1	2	-	-	-	1	1	-	-	3	2	3
CO4	3	3	3	-	2	-	-	-	1	1	-	-	3	3	3

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

COURSE CONTENTS:

Unit -I: Digital Electronics and Number Systems

Digital Electronics: Introduction, Switching and Logic Levels, Digital Waveform. Number Systems: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. **Number base conversions:** Binary to Decimal, Decimal to Binary, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Decimal to Octal, Octal to Decimal, Decimal to Hexadecimal, Hexadecimal to Decimal,

Octal to Hexadecimal, Hexadecimal to octal. Complement of Binary Numbers. Binary addition, binary subtraction Boolean Algebra Theorems, DeMorgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, NAND Gate, NOR Gate, XOR Gate, XNOR Gate. Algebraic Simplification, NAND and NOR Implementation NAND Implementation, NOR Implementation. Half adder and Full adder Implementations.

Unit-II: Semiconductor Diodes and Applications

p-n junction diode, Characteristics and Parameters, Diode approximations, DC load line analysis, Half- wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zenerdiode voltage regulators: Regulator circuit with no load, Loaded Regulator. Numerical examples as applicable.

Unit-III: Bipolar junction Transistors

BJT configuration: BJT Operation, BJT voltages and currents, BJT amplification, Common Base, Common Emitter and Common Collector Characteristics, Numerical examples as applicable.

BJT Biasing: DC load line and Bias Point, Base Bias, Voltage divider Bias, Numerical examples as applicable.

Unit-IV: Electronic Devices and Applications

SCR, controlled rectifier-full bridge type. Oscillators and applications. OPAMP-summer, subtractor, integrator and differentiator, and typical applications in measurements.

Communication system, embedded system, cellular communication, satellite communication, remote sensing. (Block diagram approach).

RECOMMENDED LEARNING RESOURCES:

1. David A.Bell,"Electronic Devices and Circuits",Oxford University Press,5th Edition,2008.
2. D.P.Kothari,I.J.Nagrath,"BasicElectronics",McGraw Hill Education(India)Private Limited,2014.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCC15F2400	Computer Concepts and C Programming	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objective of this course is to:

1. Introduce the fundamentals of computer System and Explain the different Unix commands, their usage and their syntax.
2. Explain the different programming constructs of C to be used for a given application.
3. Illustrate the Usage of iterative statements, Arrays for solving the real-world problems.
4. Demonstrate the use parameter passing mechanism, strings and pointers for solving the real-world problems.

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

1. Apply the basic Commands of UNIX to read and print a file.
2. Identify the basic programming constructs of C to be used to compute the roots of quadratic equation.
3. Develop a C program to find transpose of a matrix using Iterative statements (loops) and Arrays.
4. Build a C program on concatenate two strings and parameter passing mechanism using the function.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	3	3	3	3
CO2	3	2	3	3	2	-	-	-	-	-	-	3	3	3	3
CO3	3	2	3	3	2	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3

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

COURSE CONTENTS:

Unit-I:

Introduction to Computer System: Definition of Computer, Structure of a computer, Basics of computer hardware and computer software, Types and Functions of operating system. Algorithms and Flow charts.
Getting started with UNIX: Introduction to Unix Operating System, Introduction to Basic Command Format, Using the VI text editor, Basic UNIX commands, Types of computer networks.

Unit-II:

Fundamentals of Problem Solving and Introduction to C Language: Introduction to C Language – Structure of a C Program, Data type, Variables, Constants, Input / Output, Tips and common programming errors.
Operators: Types of Operators, Expressions and Statements.

Branching constructs: Conditional Branching- if, if-else, else-if ladder, nested if, switch. Unconditional- goto, break, continue, and return.

Unit-III:

Looping constructs: for, while, do- while, nested-for, Advantages of Looping.

Arrays: One Dimensional and Two Dimensional Arrays; Searching Techniques, Sorting-bubble sort;

Unit-IV:

Functions: Inbuilt and User defined Functions, Parameter Passing mechanisms, Call by value and Call by address;

Strings: String Operations with and without using inbuilt String Functions;

Pointers: Introduction to Pointers.

RECOMMENDED LEARNING RESOURCES:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGrawHill
2. Kernighan, Dennis Ritchie, The C Programming Language ,2nd edition, Englewood Cliffs, NJ: Prentice Hall,1988
3. Sumitabha Das, UNIX Concepts and Applications, 4th Edition; Tata McGrawHill
4. B.S. Anami, S.A. Angadi and S. S. Manvi, Computer Concepts and C Programming*: A Holistic Approach, PHI, Second Edition,2008.*
5. E. Balaguruswamy, Programming in ANSI C, 4th Edition, Tata McGraw Hill,2008.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTES15F2500	Environmental Sciences	16	FC	1	1	0	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Gain knowledge on the components of environment and importance of environmental studies.
2. Understand the various types of energy and natural resources.
3. Acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of ecosystem.
4. Get knowledge about environmental pollution-sources, effects and control measures of environmental pollution.
5. Explore ways for protecting the environment.

COURSE OUTCOMES:

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

1. Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.
2. Get motivation to find new renewable energy resources with high efficiency through active research and innovation.
3. Critically analyse the ecological imbalances and provide recommendations to protect the environment.
4. List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution controlled products.

CO PO & PSO MAPPING:

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	-	2	-	2	3	3	-
CO2	3	2	3	3	2	3	3	-	3	-	3		3	3	-
CO3	3	2	3	3	2	3	2	2	2	-	2	2	3	2	-
CO4	3	3	3	3	3	3	3	-	3	2	3	-	3	3	-

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

COURSE CONTENTS:

UNIT –I:

Introduction: Basic definitions, Objectives and Guiding principles of Environmental Studies, Components of Environment, Structures of atmosphere, Man-Environment relationship, Impact of Technology on the environment, sustainable environment, Environmental Protection - Role of Government, Initiatives by Non - Governmental Organizations(NGO)**.**

UNIT – II:

Energy & Natural Resources: Energy - Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources - Hydro Electric, Fossil fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative future source of Energy, Natural Resources- Water resources, Mineral Resources, Forest Wealth.

UNIT – III:

Ecology & Ecosystems: Ecology- Objectives and Classification, Concept of an ecosystem - structure & function, Balanced ecosystem, Components of ecosystem - Producers, Consumers, Decomposers, Bio- Geo- Chemical Cycles & its Environmental significance (Carbon Cycle and Nitrogen Cycle), Energy Flow in Ecosystem, Food Chains: Types & Food webs Ecological Pyramids.

UNIT – IV:

Environmental Pollution: Introduction, Types, Concepts -Air Pollution, Water Pollution& Noise Pollution. Environmental Degradation- Global Warming, Green Houses Effects, Acid Rain, and Depletion of Ozone Layer.

RECOMMENDED LEARNING RESOURCES:

1. BennyJoseph(2005),"Environmental Studies",TataMcGraw–HillPublishing Company Limited
2. Meenakshi P. (2006), "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi
3. RajagopalanR.(2005),"Environmental Studies–FromCrisistoCure",Oxford University Press

REFERENCES:

1. Raman Sivakumar, (2005), "Principles of Environmental Science and Engineering", Second Edition, Cengage learning,Singapore
2. Ranjit Daniels R.J. and Jagdish Kirshnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi
3. Prakash S.M.(2007),"Environmental Studies",Elite Publishers,Mangalore
4. Erach Bharucha(2005),"Text Book of Environmental Studies",for UGC,University Press
5. Tyler Miller Jr.G.(2006),"Environmental Science–WorkingwiththeEarth",Eleventh Edition, Thomson Brooks/Cole
6. "Text Book of Environmental and Ecology" by Dr.Pratibha Sing,Dr.Anoop Singh and Dr. Piyush Malaviya. Acme Learning Pvt. Ltd., NewDelhi.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCC15F2600	Technical English – II	16	FC	1	1	0	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Make the learning process more practical and participatory.
2. Enhance the process of imparting skills of communication more effective
3. Make the learners aware of the latest communication tools and process.
4. Encourage participation of students and follows an interactive approach.
5. Cater the learners in professionals and academic contexts and in day-to-day Interactions.

COURSE OUTCOMES:

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

1. Students eradicate their stage fear, able to communicate properly.
2. Students enable to speak, read without any mistakes.
3. Practice LSRW skills and how to use them in a daily life.
4. It exhibits clarity of language, encourages participation of students and follows an interactiveapproach.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	1	3	1	3	3	3	-
CO2	-	-	-	-	-	-	-	3	1	3	1	3	3	3	-
CO3	-	-	-	-	-	-	-	3	1	3	1	3	3	3	-
CO4	-	-	-	-	-	-	-	3	1	3	1	3	3	3	-

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

COURSE CONTENTS:

Unit- I:

Language in Use: Vocabulary Building, Functional Words, Idioms & Phrasal Verbs, Homonyms & Homophones.

Unit-II:

Employability Skills: Job Applications, Curriculum Vitae, Group Discussions, Presentation Skills, Role Plays, Interview Skills, Debates

Unit-III:

Academic Writing – II: Essays, Letters, Dialogues, Proposals

Unit-IV:

Technical Speaking & Reading Skills: Precis (Scientific Passages), Public Speeches, Reading Manuals, Reading Scientific Reports, Interpreting Visual Materials.

REFERENCES:

1. Bansal, R.K. and J.B. Harrison "Spoken English" Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma "Technical Communication" Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe "Objective English" Pearson Education, 2013.
4. Dixson, Robert J. "Everyday Dialogues in English" Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. "ABC of Common Errors" Mac Millan Publishers, 1995.
6. Samson, T. (ed.) "Innovate with English" Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). "Effective English" Pearson Education, 2009.
8. Goodale, Malcolm "Professional Presentation" Cambridge University Press, 2013.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTED15F2700	Computer Aided Engineering Drawing	16	HC	2	0	2	4	6

COURSE OBJECTIVES:

1 Comprehend general projection theory, with emphasis on orthographic projection to represent in two-dimensional views (principal, auxiliary, sections).

2 Dimension and annotate two-dimensional engineering drawings.

3 Understand the application of industry standards and best practices applied in engineering graphics.

4 Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.

5 Introduction of CAD software for the creation of 2D engineering drawings.

6 The theoretical concepts delivered in this course would help the students to understand the sign considerations and tolerances to be used in the design and manufacture of engineering components.

7 This course will be very much basics for students to learn and wisely apply for the advanced Computer Aided Engineering (CAE) tools such as ABAQUS, ANSYS etc.

COURSE OUTCOMES:

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

1. Be industry ready and able to develop independent thinking and problem-solving capabilities.
2. Be able to express component descriptions as per the commonly practiced standards.
3. Be able to produce 2D and simple 3D drawings.
4. Be able to comprehend industry specific drawing.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	1	1	1	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-	-	-	-

CO4	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-

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

COURSE CONTENTS:

UNIT – I:

Introduction to Drawing: Introduction to Engineering Drawing: Introduction, Drawing Instruments and their uses, BIS conventions, Drawing sheets, Lettering, Dimensioning, Scales, regular polygons and its methods, tangents, ellipse, parabola, hyperbola, loci, cycloids, trochoids, epi and hypocycloids, spirals and involutes, helix, Co-ordinate system and reference planes.

Introduction to Software (solid edge): Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend to next, split, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering.

Orthographic Projection: Projection – Orthographic Projection – Planes of Projection – Four quadrants– First-angle projection – Third-angle projection – Reference line – Conventions employed.

Projection of points: Points in different quadrants.

Projection of Straight Lines (First-angle Projection only): Parallel to one or both planes – Contained by one or both planes – Perpendicular to one plane and parallel to other plane – Inclined to one plane and parallel to the other – Inclined to both planes.

Projection of Planes: Types of Planes – Perpendicular Planes – Oblique Planes – Projection of Planes - Parallel to one Plane – perpendicular to both planes – perpendicular to one inclines to other – Oblique planes (only change of position method).

UNIT –II:

Projection of Solids: Polyhedra (Cube – Tetrahedron - Prisms and Pyramids) – Solids of revolution(Cone and Cylinder) – Solids in simple position – Axis perpendicular to a plane – Axis parallel to both planes – Axis parallel to one plane and inclined to the other – Axis inclined to both plane (only change of position method).

UNIT – III:

Sections of Solids: Section Planes – Sections – True Shape of Section – Sections of Prisms – Sections of Pyramids – Sections of Cylinders – Section of Cones. Developments of Lateral Surfaces of Solids - Polyhedra (Cube – Tetrahedron - Prisms and Pyramids) – Solids of revolution (Cone and Cylinder) and their Frustums.

UNIT – IV:

Isometric Projection : Isometric axes - Lines and Planes – Isometric Scale – Isometric Projection of Planes – Prisms – Pyramids – Cylinders – Cones – Spheres - Hemi-Spheres - frustums - Combination of Solids (Maximum Three). Conversion of Orthographic Drawing to Isometric View / Pictorial Drawing of a simple Machine Components. Application Drawings: Civil drawing (building plans), electrical symbols and circuits, electronic symbols and circuits and simple assembly drawing (bolt and nut).

REFERENCES:

1. Engineering Graphics - K.R. Gopalakrishna, 32nd Edition, 2005 –Subhas Publishers, Bangalore.
2. EngineeringDrawing–P.S.Gill,11thEdition, 2001–S.K.Kataria & Sons,Delhi.

E-MATERIAL:

1. Computer Aided Engineering Drawing- Vol I, (PPT) by Dr. RajashekarPatil and Prof Gururaj Sharma

RECOMMENDED LEARNING RESOURCES

1. EngineeringDrawing–N.D.BhattandV.M.Panchal,48thEdition,2005–Charotar PublishingHouse, Gujarat.
2. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU,Belgaum.
3. Computer Aided Engineering Drawing by Dr Balaveer Reddy and Coauthors,CBS Publications,2014

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCL15F2800	Engineering Chemistry Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

COURSE OUTCOMES:

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

1. Handle different types of instruments for analysis of materials.
2. Carryout different types of quantitative estimations of materials.
3. Handle different types of instruments for accuracy and precision.
4. Carryout different types of titrations.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	2	-	-	3	3	-	-	3	-	-
CO2	3	3	1	-	-	2	2	-	3	3	-	-	3	-	-
CO3	3	3	-	-	-	2	2	-	3	3	-	-	3	-	-
CO4	3	3	1	-	-	1	1	-	3	3	-	-	3	-	-

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

LIST OF EXPERIMENTS:

1. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$.
2. Conduct metric estimation of an acid mixture using standard NaOH solution.
3. Determination of pKa of a weak acid using pHmeter.
4. Determination of molecular weight of given polymer sample using ostmail's Viscometer.
5. Colorimetric estimation of copper.
6. Determination of COD of the given industrial waste water sample.
7. Determination of total and temporary hardness of water using disodium salt of EDTA.
8. Estimation of alkalinity of given water sample using standard HCl solution.
9. Determination of Iron in the given hematite ore solution using potassiumdi chromate.
10. Determination of calcium oxide in the given sample of cement by rapid EDTA method.
11. Flame photometric estimation of sodium in the given sample of water.
12. Electroplating of copper and nickel.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCP15F2900	Computer Programming Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the Basic Principles of Problem Solving using a Computer.
2. Present and Provide the Programming Constructs of 'C' Programming Language.
3. Provide the skills required to Design, Demonstrate and Implement Computable Problems / Mini-projects/Projects using 'C' Programming Language.
4. Provide the Arena for Development of Analytical, Reasoning and Programming Skills.
5. Set the Strong Foundation for Software Development in the field of Programming and hence to Create high quality 'C' Professionals.

COURSE OUTCOMES:

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

1. Understand the Basic Principles of Problem Solving.
2. Study, understand and identify the Representation of Numbers, Alphabets and other Characters in the memory of Computer System.
3. Understand Analyze, Integrate, Apply and Demonstrate Software Development Tools; like Algorithms, Pseudo Codes and Programming Structures.
4. Study, Understand, Analyze and Categorize the logical structure of a Computer Program, and hence to Apply different programming constructs to develop a Computer Program using 'C' Programming Language.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	2	-	-	-	3	3	-	-	3	3	-
CO4	3	2	1	1	-	-	-	-	3	3	-	-	3	3	3

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

LAB EXPERIMENTS:

1. a) Program to print the name, college name, Address of a student.
   b) A company for aadhar card want's to collect its employees information. Write a program to take inputof employee name and age.
2. Program to read and print the size of variables of different datatype.
3. Arithmetic operations are widely used in many programs. Write a program to perform addition, subtraction, multiplication, modulo division, and division operations.
4. A person has deposited some amount in bank. Write a program to calculate simple interest and compound interest on amount for a period.
5. In Delhi, four wheelers run on the basis of even or odd number. Write a program to identify whether vehicle registration number is even or odd.
6. People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a program to find the coefficients of a quadratic equation and compute its roots.
7. Consider the age of 3 persons in a family, write a program to identify the eldest person among three of them.
8. Consider student's marks in Computer Test. Write a Program display the grade obtain by student in Computer Test based on range.
9. Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a program to design a basic calculator that performs the basic operations and you want to give choice to user to perform
   a. Addition of two numbers
   b. Subtraction of two numbers
   c. Multiplication of two numbers.
   d. Division of two numbers.
   e. Wrong choice
10. In a stock market at the end of the day we do the summation of all the transactions.
    a. Write a program to display numbers (transactions) from1 ton.
    b. Write a program to find the sum of n natural numbers.
11. Read your ATM Pin Number. Write a program to identify your Pin Number is palindrome or not**.**
12. Read your Landline Number. Write a program to print the reverse of it and also find sum of digits of your Landline Number.
13. Create a Contact list of n friends, Write a program to read and print the Phone number of your friend's.
14. In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a program to perform matrix Multiplication and check compatibility of matrix.
15. You have joined a startup company of N employees; Write a program is to sort all employee id.
16. A student has taken 10 books from the library. Every time he take's the book, Librarian read's its ISBN Number. Write a program to identify whether book is issued to him or not based on ISBN Number.
17. Suppose students have registered for workshop, and their record is maintained in ascending order based on student id. Write a program to find whether a particular Student has registered for that particular workshop or not.
18. In a CCP test you scored less marks compared to your friend, Write a program to swap your marks with your friend.
19. In a memory game, you first enter a string wait for a time and again enter second string, Write a program to check both sting were same or not.
20. Read your first and last name in two different strings; Write a program to combine these two strings into third string.
21. Assume a person has entered a Password ,Write a program so that he can know the length of his password,
22. Read a meaningful word in English, Write a program to identify the word when inversed yields the same or not.

RECOMMENDED LEARNING RESOURCES:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition; Tata McGraw Hill
3. Reema Thareja, Computer fundamentals and programming inC.
4. Kernighan, Dennis Ritchie, The C Programming Language ,2nd edition, Englewood Cliffs, NJ: Prentice Hall,1988 http://c-faq.com/index.html
5. Paul Deitel, C How to Program, 7th Edition, Deitel How toSeries.
6. B.S. Anami, S.A. Angadi and S. S. Manvi, Computer Concepts and C Programming*: A Holistic Approach, PHI, Second Edition,2008.*

II Year

Detailed Syllabus

III Semester Syllabus

THIRD SEMESTER:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3100	Discrete Mathematical Structures	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of the course are to:

Provide an understanding of the concepts and application of set theory, logic, relations and functions, principles of counting and to know the algebraic structure with one binary operation and two binary operations.

COURSE OUTCOMES:

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

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Verify the correctness of an arguments.
3. Perform operations on discrete structures such as sets, relations and functions.
4. Apply algorithm and use definition to solve problems to prove statements.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I: Set Theory and Logic:

Fundamentals of sets, Sub sets, Venn diagrams, Operations on sets, Laws of set theory, Countable and uncountable sets, Addition- principle, Extended Addition Principle.

Propositions, Logical connectives and truth tables (illustrative example), Logical equivalence , Laws of logic, Duality, NAND and NOR connective(Circuits), Converse ,Inverse and Contra positive, Rules of inference , Open statements, Quantifiers, Logical implication involving quantifiers, Statement with more than one variable, Methods of proofs and disproof.

UNIT – II: Relations and Functions:

Cartesian product of Sets (illustrative example), Matrices and Digraphs of relations, Operations on relations, Properties of relations, Equivalence relations, Partial ordered relations, Posets, Hasse diagrams, Extremal elements in posets.

Types of Functions, Properties of Functions, The pigeonhole principle, Composite functions, Invertible functions, Floor and ceiling function, Sterling numbers of second kind.

UNIT – III: Principles of counting

The rules of sum and product, Permutation, Combination, Binomial and Multinomial theorem(without proof), Combination with repetition, Catalan numbers. Principle of inclusion and exclusion, Derangements and Rook polynomial.

UNIT – IV: Groups and Coding theory:

Groups with one binary operation, Semi groups, Monoids, Product and quotient of groups, Isomorphism, Homomorphism, Cyclic groups, Algebraic structure with two binary operations, Lagrange's theorem, Coset decomposition of groups, Rings, Integral domain and fields. Codes and group codes, The Hamming Metric, The Parity check matrices, Generator matrices.

RECOMMENDED LEARNING RESOURCES:

1. Ralph P Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, 5th Edition, 2014

REFERENCES:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 5thedition, Tata McGraw-Hill,2014.
2. C. L. Liu, Elements of Discrete Mathematics, 4th edition, Tata McGraw-Hill,2014.
3. ThomasKoshy, Discrete Mathematics with Applications, Elsevier,2012.
4. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Asia,2015.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3200	Data Structures and Algorithms	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objective of this course are to:

1. Provide the students with solid foundations in the basic concepts of programming: data structures and algorithms.
2. Familiarize the concept of Abstract Data Types (ADT) and Implement ADT in several programming languages.
3. Explain the knowledge of structure, operations and applications of various data structures like arrays, structures, unions, lists, stacks, queues, trees, graphs, hash tables and heaps.
4. Introduce the concept of analyzing the problem, then develop an algorithm and evaluate its performance in terms of time and space at best, average and worst cases.

COURSE OUTCOMES:

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

1. Design or select an appropriate data structures and algorithm for a particular problem.
2. Impart the effectiveness of data structures and algorithms for solving a given problem.
3. Implement selected data structures and algorithms.
4. Apply the knowledge of data structures in writing more efficient programs in a programming language.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

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

structures.

Unit – II:

Data Structures-1:, Pointers: Introduction, Recursion, Stacks, Queues: Simple, circular and priority Queues, Linked Lists: Singly and Doubly Linked List

Unit – III:

Data structures-2 : Trees: Terminologies and types, Binary Trees, Binary Search Trees, Tournament Trees, Heaps, Hash Tables, Graphs and Algorithms: Basic Terminologies and BFS DFS Algorithm.

Unit – IV:

Searching and Sorting: Linear search, Binary Search, Insertion sort, Bubble sort, Selections sort, Merge sort, Heap sort and Quick sort.

RECOMMENDED LEARNING RESOURCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, IT Press,2002.
2. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press,2007.

REFERENCES:

1. Shi Kuo Chang, Data Structures and Algorithms, World Scientific,2003
2. Joshi, Data Structures and Algorithms In C, Tata McGraw-Hill Education,2010.
3. Richard Gilberg, Behrouz Forouzan, Data Structures: A Pseudo code Approach with C, CengageLearning,2004.
4. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, Addison-Wesley, 1987.
5. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson,2002.
6. Elsevier, Journal of Discrete Algorithms
7. ACM, Journal of Experimental Algorithmics(JEA)
8. ACM, ACM Transactions on Algorithms(TALG)
9. IEEE, IEEE Transactions on Computers

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3300	Advanced Computer Programming	16	HC	2	1	1	4	6

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide an in-depth understanding on advanced concepts like pointers; structures; files with examples in C language.
2. Introduce the different problem domains and teach how to solve programmatically.
3. Enforce the concepts of UNIX shell scripting and its applications.
4. Introduce Java Programming fundamentals.

COURSE OUTCOMES:

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

1. Explain structures, pointers are and their applications in solving problems.
2. Handle file operations and map those to solve database related problems.
3. Explain and use different Unix commands, such as grep, find, awk, sed.
4. Design Unix shell scripts to solve different practical problem; Program in Java.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Pointers: What Are Pointers?, Pointer Variables, The Pointer Operators, Pointer Expressions, Pointer Assignments, Pointers and Arrays, Arrays of Pointers, Multiple Indirection, Initializing Pointers, C's Dynamic Allocation Functions; **Structures:** Accessing Structure Members, Structure Assignments, Arrays of Structures, Passing Entire Structures to Functions, Using Structure Pointers; **Unions**; **File Handlings**: Opening and Closing a File and strings.

Unit-II:

Introduction to UNIX Architecture; Introduction to Shell scripting, types of shell, Shell Scripting basics:

Command redirection and pipeline, control constructs, Commands on Files and Directories;

Unit-III:

The History and Evolution of Java, Overview of Java, Object oriented programming, Three OOP Principles, Data Types, Primary datatypes, Characters, Booleans, Variables, Arrays, One-Dimensional Arrays, Multidimensional Arrays, Operators in Java, Arithmetic, Boolean and Relational Operators.

Unit-IV:

Control statements – if, switch, Iteration Statements, while, do-while, for, Nested Loops, Jump Statements, Using break, Using continue, return, introducing classes, class fundamentals, declaring objects, constructors, finalize method, A Closer Look at Methods and Classes, Introducing Access Control, Understanding static, Introducing final, Inheritance, inheritance basics, using super key.

RECOMMENDED LEARNING RESOURCES:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill Education Private Limited, 2000.
2. Randal K. Michael, Mastering UNIX Shell Scripting, 2nd Edition, Wiley Publications,2008.
3. Jeff Friesen, Beginning Java 7, Springer India Private Limited,2011.
4. Kernighan, Dennis Ritchie, the C Programming Language, 2nd Edition, Englewood Cliffs, NJ: Prentice Hall,1988.
5. Richard M. Reese, Oracle Certified Associate, Java SE 7 Programmer Study Guide, Packt Publishing Ltd,2012.
6. PaulFischer,Introduction to Graphical user Interfaces with Java Swing,EdisonWesley,2005.

REFERENCES:

1. Jeff Friesen; *Beginning Java 7*; Apress;2011.
2. Kernighan; Dennis Ritchie; *the C Programming Language*; 2nd Edition; Englewood Cliffs; NJ: Prentice Hall;1988.
3. Richard M. Reese; *Oracle Certified Associate; Java SE 7 Programmer Study Guide*; Packt Publishing Ltd; 2012.
4. Paul Fischer; *Introduction to graphical user interfaces with Java Swing*; Edison Wesley;2005.
5. IEEE, IEEE Transactions on Computers.
6. IEEE, Computing in Science and Technology.
7. ACM, ACM Journal on Emerging Technologies in Computing Systems(JETC).
8. Elsevier, Recent Science of Computer Programming Articles.

Lab Experiments:

1. **Book Information System using Structures :** In recent years, the companies like Amazon, flipcart, and many more keeps the about books for academics and research online so that people can place orders and can do transaction such applications require the concept of structure for storing and processing the information. Write a C-program for Book Information System with the following features.

- Define the book information structure with members like title, book_id, author and subject.
- Create separate instances to store the information about multiple books. In this example, you may take two books on starting.
- Read and display the actual information of book information structure members.

  Note: You may consider more information about the book and define book structure accordingly. You may also store/display the more books information. To access the structure members, use "." Operator

1. **Bank Application using user defined data type from structure**: Many operations are done for each account in the bank either by the account holder or by the bank. Sequences of actions are executed for each operation. Write a C code for developing real-time Bank application operations. This program will perform all the below operations.

- Creating new account – To create a new account
- Cash Deposit –To Deposit some amount in newly created account
- Cash withdrawal - To Withdraw some amount from your account
- Display Account information –It will display all information of the existing accounts
- Logout

Clearing the output screen and display available options

2. **Structure Assignment:** Many universities have physical library where the list of books are maintained for each book. As many student need same book, multiple copied are maintained in the library. To store the information about same book, the previously stored information can be copied to the next books records. C-structure assignment can be used to copy the records information from one variable to other easily.

   Write a C-program for copying the information stored in one structure variable to another same type of structure variable so that both the structure variable contains the same information. Here, two variables declared of type same structure data type. The value for the structure members in one of the structure variable is stored. These values are assigned using one of the ways for structure assignment in C to another structure variable.

3. **An eBay-Store Information System using Structure and Union:** An eBay store information system maintains the availability of products in the store. Suppose it consists of two products, diesel motor and apples. The store keeps track of the remaining products in the store. The diesel information tracked in terms of how many number of units available in the store whereas the apple information is tracked in terms of how many kg apples are available in the store. While storing the tracked information for each product, union concept in C can be used to reduce the memory usage during the execution.

   Write a C-program for developing an eBay store information system for tracking the availability of products in the store. Use the structure for storing attributes about the products with members such as name of the product for selling, price per unit, type of unit and how much availability of each product. Store the availability of each product using union as each product measurement unit is different. Also print the availability of each product.

4. **Employee Database Management System using Files:** We frequently use files for storing information which can be processed by programs. In order to store information permanently and retrieve it we need to use files and this lab program demonstrates creation of a file, Storing Information in a file and Reading the data present in the file.

   Most of the organizations keep the information about each employee in the form of database so that they can retrieve it as and when it is required. Such database can be stored in the file. Each employee information is stored as a record which consists of employee details such as

   name, age and basic salary. Various operations can be done on this database to maintain it recent information about all employee. Write a menu-driven C-program for elementary employee database management that store the employee information in files and perform following operations as the user selects.

   - Writing the employee data in the employee database file
   - Reading the employee data from the employee database file
   - Modify the employee record in the employee database file

   Delete the employee record from the employee database file

5. **UNIX Shell Scripting:** Time is precious. It is non-sense to waste time typing a frequently used

sequence of commands at a command prompt, more especially if they are abnormally long or complex. Scripting is a way by which one can alleviate this necessity by automating these command sequences in order to make one's life at the shell easier and more productive. Scripting is all about making the computer, the tool, do the work. Hopefully by the end of this tutorial you should have a good idea of the kinds of scripting languages available for UNIX and how to apply them to your problems. UNIX contains many wonderful and strange commands that can be very useful in the world of scripting, the more of the tools you know and the better you know them, the more use you will find for them in your scripting. The various shells all have built in functions which allow for the creation of shell scripts, that is, the stringing together of shell commands and constructs to automate what can be automated in order to make life easier for the user.

The simple shell scripts written in this lab used for the following purposes using lists of UNIX commands.

1. Customizing your work environment.
2. Automating Your Daily Task.
3. Automating Repetitive Task.
4. Executing Important Procedures like shutting down the system, formatting a disk, Creating a file system on it, mounting the file system, letting the users use the floppy and finally un mounting the disk.
5. Performing the same operation on many files.
6. **Pointer Structure Variable:** Write a simple program to understand the pointer concept that can be used to record the database of the student using structures pointer variables. In the program, declare pointer to the student structure and print the contents of the structure member of using structure pointer.
7. **Retrieving an Address and Value of The Variable using Pointers:** As mentioned in lab program 4, many organizations maintain employee record database. In this lab program, you will use pointers to the employee structure for storing the information in the database file. The memory is allocated using dynamic memory allocation for the structure members before storing the corresponding information. The content of this memory should be stored permanently in the database file for doing further operations. Write such C Program to create employee record and update it.
8. **Updating Employee details using JAVA:** Write a java program for creation of Employee class which has four variables such as name, age, designation and salary. The program should read and display the values stored in the corresponding instance variables declared from Employee class.
9. **Employee salary management using Polymorphism in JAVA:** Write a java program to create a class called employee with variables name, address and number. Inside the class define a function with the same name of the class to instantiate Salary objects by using employee and salary reference from a employee database.
10. **Animal Properties using Inheritance in Java:** Write a java program to show how base class named Animal used to create inherited class for specific animal such as Dog. The Animal class properties are inherited by Dog class that allows Dog class to call Animal class functions.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3400	Digital Principles and Logic Design	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide a strong knowledge of digital electronics.
2. Give a foundation of building blocks used in digital design.
3. Introduce basic postulates of Boolean algebra.
4. Introduce the methods for simplifying Boolean expressions.
5. Outline the formal procedures for the analysis and design of combinational and sequential circuits.

COURSE OUTCOMES:

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

1. Construct the K-map from a Boolean expression and to find the minimal SOP/POS forms.
2. Design combinational and sequential digital logic circuits.
3. Solve real-world problems using Boolean relation between inputs and output.
4. Design the operation of basic building blocks, such as different types of latches, flip-flops, registers and counters.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Principle and Minimization Techniques of combinational Circuits: Introduction to combinational logic; Minimization Techniques: Boolean postulates and laws, De-Morgan's theorem; Boolean algebra; Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS); 3, 4 and 5 Variable Karnaugh map; Quine-McCluskey method.

Unit – II:

Analysis and Design of Combinational Circuits: Half adder; full Adder; half subtractor; full subtractor; Serial Adder/Subtractor; Carry Look Ahead adder; BCD adder; encoder and decoder; multiplexers and demultiplexers;

cascading of Mux; Boolean function implementation using Mux and decoders

Unit- III:

Introduction to Sequential circuits: The S R Latch; switch debouncer; edge and level triggering, flip- flops: SR, JK, D, T, and Master-Slave; Characteristic tables and equations; registers, shift register, universal shift register

Unit- IV:

Sequential Design: Counters: Binary ripple Up/Down counter, design of synchronous mod-*n* counter using flip-flop; Introduction to Mealy and Moore model circuits; state machine notation, synchronous sequential circuit analysis

RECOMMENDED LEARNING RESOURCES:

1. D P Leach, A P Malvino, and GouthamSaha, Digital Principles and Applications, Tata McGraw-Hill, 7th edition,2006.
2. Moshe Morris Mano, Digital Design, Prentice Hall, 3rd edition,2004.
3. Samuel C Lee, Digital Circuits and Logic Design, PHI Course Pvt. Ltd.,2008.
4. Charles H Roth Jr., Fundamentals of Logic Design, Cengage Course, 5th edition,2014.
5. John M Yarbrough, Digital Logic Applications and Design, Thomson Course,2001.
6. Donald D Givone, Digital Principles and Design, Tata McGraw-Hill 2002.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3500	Computer Organization and Architecture	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide the knowledge of Basic computer structure; Performance measurement and basic concept of Machine Instruction.
2. Introduce the concept of Input and Output Device Access; Controlling device request and Interface Circuits.
3. Provide the Knowledge of various Memory Devices used in computers.
4. Enforce Arithmetic Data Processing of Signed and Unsigned numbers with Processing Circuits.

COURSE OUTCOMES:

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

1. Apply the knowledge of basic computer structure to evaluate system performance.
2. Apply the rules in performing signed number Arithmetic operations.
3. Write program Units using conditional codes and Assembler Directives.
4. Compare Different Input Output Organization Schemes.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Structure of Computers and Machine Instructions: Functional Units; Performance Measurement; Number Representation; Addition of Positive Numbers; Addition and subtraction of signed numbers; Overflow; Basic Instruction types; Branching; Condition Codes; Addressing Modes; Assembler Directives; Basic I/O Operation; Stack; Subroutine; Logic Instructions

Unit-II:

Input Output Organization: Accessing I/O devices; Interrupts; Handling Multiple Devices; Controlling Device Request; Exception; Direct Memory Access; Buses; Interface Circuits; PCI Bus; SCSI Bus

Unit-III:

Memory System: Basic concepts; RAM Memories; ROM Memory; Cache Memory; Virtual Memory; Secondary Storage

Unit-IV:

Arithmetic and Basic Processing: Addition and Subtraction of Signed Numbers; Design of Fast Adders; Multiplication of Positive numbers; Signed-Operand Multiplication; Fast Multiplication; Integer Division; Floating Point numbers and Operations; Fundamental concepts of Basic processing unit; Execution of Complete Instruction; Hard Wired Control; Micro Program Control

RECOMMENDED LEARNING RESOURCES:

1. Carl Hamacher,Zvonko Vranesic and Safwat Zaky,*Computer Organization*,5th Edition,Tata McGraw Hill,2011.
2. William Stallings*, Computer Organization and Architecture – Designing for Performance*, 6th Edition, Pearson Education,2003.
3. Mostafa Abd-El-Barr and Hesham El-Rewini, *Fundamentals of Computer Organization and Architecture*, John Wiley & Sons Inc. Publication,2005.

Course Code	Course Title	Duration (Weeks)	L	T	P	C	Hrs./ Wk.
BTCS15F3600	Engineering Mathematics – III	16	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of the course are to:

To study and understand the applications approach of the concepts of Numerical methods, Probability, random variables and Sampling distributions in various fields of engineering.

COURSE OUTCOMES:

After the completion of the course the student will be able

1. To understand the basics of numerical methods and their applications.
2. To solve the problems of Probability and statistics in various engineering fields.
3. To apply the numerical methods and Sampling Theory concepts.
4. To solve various engineering problems.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT-I

Numerical Methods–I: Introduction, solution of algebraic and Transcendental equation, Bisection method , Regula false method , Newton Raphson method.

Finite differences and Interpolation:-Forward and Backward differences , Newton's forward and Backward interpolation formulae, Divided differences-Newton's divided difference formula, Lagrange's Interpolation formula and Inverse Interpolation formula and Problems.

UNIT -II

Numerical Methods–II: Numerical Differentiation and Integration:-Derivatives using Newton's forward and backward difference formula, Trapezoidal Rule, Simpson's $1/3^{rd}$,$3/8^{th}$Rule,Weddle's formula and Problems.

Numerical solutions to ODE: (First order and first degree) Picards Method, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kuttamethod of fourth order, Adam's-Bash forth Predictor-corrector method and Problems.

UNIT-III

Curve fitting by the method of least squares: $y=a+bx$,$y=ab^x$,$y=a+bx+cx^2$,Correlation, correlation coefficient, Rank correlation, Regression Analysis.

Introduction of Probability, Probability associated with set theory, addition law, conditional Probability, multiplication law, Baye's Theorem.

UNIT-IV

Random variables (discrete and continuous), Probability density function, probability distribution – binomial and Poisson's distributions; exponential and normal distributions.

Sampling theory:-Sampling, Sampling distributions, standard error, test of hypothesis for means and confidence limits for means and distributions and Chi-square distributions.

RECOMMENDED LEARNING RESOURCES:

1. B.S.Grewal,"Higher Engineering Mathematics",Khanna Publishers,43nd edition,2015.
2. Erwin Kreyszig,"Advanced Engineering Mathematics",Wiley Publications,10th edition, 2015.

REFERENCES:

1. B.V.Ramana,"HigherEngineeringMathematics",Tata McGraw Hill Publications,19th edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition,2014.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3700	Data Structures Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. To develop skills to design and analyze simple linear and nonlinear data structures.
2. Build the ability of analyzing the problem and then to use data structures appropriately in solving a problem.
3. Be familiar with writing recursive methods.
4. Build the ability to develop algorithms and evaluate the performance of it in terms of time and space at best; average and worst cases.

COURSE OUTCOMES:

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

1. Design or select an appropriate data structures for a particular problem.
2. Design or select an appropriate algorithm for a particular problem.
3. Reason about the effectiveness of data structures and algorithms for solving a given problem.
4. Be able to design and analyze the time and space efficiency of the data structure.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1. Consider the Software Company "XYZ" with 100 employees. Design and develop a C program to construct an array to store the id of 100 employees and use different searching techniques to search for an employee with particular employeeid.
2. Polynomials are used to graph real world curves. For example, roller coaster designers may use polynomials to describe the curves in their rides. Combinations of polynomial functions are sometimes used in economics to do cost analysis. Design and develop a C program to add two polynomials of any degree using single dimensional array.

3. Real-life quantities that are naturally described by complex numbers rather than real numbers. Design and develop a C program to add and subtract 'n' complex numbers using structure.
4. Reversal of string is used to check for palindrome or not. Design and Develop a C program to reverse a string using stack.
5. The compilers always convert infix expression into postfix to perform further operations like parsing, lexical analysis etc. Design and Develop a C program to convert an infix expression into postfixusing stack.
6. Evaluation of postfix expressions is done by compilers during the compilation process. Design and Develop a C program to evaluate a postfix expression using stack.
7. When jobs are entered in system they are stored in the job queue and whenever the processor is free the jobs are moved to ready queue for execution. Consider a college is having a printer. Design and develop a C program to implement job scheduling in the printer.

   Hint: Store the jobs based on their job id in queue.

8. In a machine gun bullets are always inserted in circular queue. Design and develop a C program to process bullets in machinegun.
   Hint: Bullet insertion and firing (deletion) can be implemented using circular queue. Bullets are given with specific id.
9. Consider the university "REVA" is having 100 students where, the details of each student like name, roll no and marks of 3 subjects is to be stored. Design and develop a C 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).
10. Consider the company "abc" is having 100 employees where, the details of each employee like name and id is to be stored. Design and develop a C program to construct a doubly linked list to enter records of different employees in list, display the list and print the names of all employees with particular employeeid.
11. Recursive functions are used to speed up the performance of any program. Design and develop C program to print the Fibonacci series using recursive function. Design and develop C program to compute ${}^{n}C_{r}$ using recursive function.

RECOMMENDED LEARNING RESOURCES:

1. Shi Kuo Chang, Data Structures and Algorithms, World Scientific,2003.
2. Joshi, Data Structures and Algorithms in C, Tata McGraw-Hill Education,2010.
3. Richard Gilberg, Behrouz Forouzan, Data Structures: A Pseudo Code Approach with C, Cengage Course,2004.
4. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, Addison- Wesley,1987.
5. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson,2002.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F3800	Logic Design and Electronics Circuits Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. To provide foundation on designing, building and testing of common combinational and sequential Digital logic circuits.
2. To provide understanding on simulation of digital logic circuits.
3. To gain experience in using general electronic instruments in design and testing of digital logic circuits.

COURSE OUTCOMES:

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

1. Design simple combinational and sequential Digital logic circuits based on given specification.
2. Build simple combinational and sequential Digital logic circuits using hardware components.
3. Apply Electronic instruments in design and testing.
4. Design Electronic device with basic operation.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1 a) Realization of Universal Gates using basic gates

b) Design and develop VHDL code to realize Universal gates using basic gates.

3 a) Realization of Half/Full adder and Half/Full Subtractors using logic gates.

b) Design and develop VHDL code to realize Full adder and Full Subtractors.

4 a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.

c) Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working.

5 a) Testing the operation of a decoder, and using it as De-multiplexer.
b) Design and develop the VHDL code for realizing a binary to Decimal decoder.

6 a) Realize the working of JK Flip-Flop using SR Flip-Flop.
b)Design and develop the VHDL code for SR Flip-Flop. Simulate and verify it's working.

7 a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulateand verify its working.

8 a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs anddemonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.

9 a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify itsworking.

10 Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate its working.
11 Design and construct a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.
12 An Electronic system is driven by a clock. The clock has a fixed frequency and Amplitude. Design the Clock generator for the Electronic system.
13 The ac signal available from the mains is to be converted into DC. Input voltages below 0.7v also are to be converted. Design a suitable circuit for the task
14 A dc power supply is to be built for driving an Amplifier circuit to make the Transistors amplify the signal. Build the power supply using different stages of the unit for the amplifier.
15 A circuit under test requires different types of input signals. Design a circuit to generate these signals which can be used fortesting.
16 It is desired to select a range of frequencies from the signal received by the sender. This signal strength after selection should be increased. Design suitable circuits that can select the range of frequency signals and amplify.

RECOMMENDED LEARNING RESOURCES:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill,2010.

2. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley,2009.

REFERENCES:

1. Stephen Brown, ZvonkoVranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGrawHill,2005.
2. RDSudhakerSamuel:IllustrativeApproachtoLogicDesign,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,Chetan D Parikh:Millman's Integrated Electronics–Analogand Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill,2010
7. R. D. Sudhaker Samuel: Electronic Circuits, Sanguine Pearson,2010

IV Semester Syllabus

FOURTH SEMESTER

Course Code	Course Title	Duration (Weeks)	L	T	P	C	Hrs./ Wk.
BTCS15F4100	Graph Theory	16	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of the course are to:

The main objective of this course is to provide an understanding of the concepts and application of graph theory.

Course Outcomes:

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

1. Use graphs as a tools to visualize and simplify situations.
2. Apply algorithm and use definitions to solve problems.
3. Analyse algorithms, determine algorithmic complexity and apply algorithm to solve problems.
4. To understand the theory and applications of graphs, fundamental theorems and their proofs.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT-I: Introduction:

Konigsberg's Bridge problem, Utilities problem, Seating Problems, graphs, Representation of graphs, Directed graphs, incidence, adjacency, degree, Indegree , out degree, regular graphs, complete graphs, Null graphs, Bipartite graphs, Isomorphism, Directed graphs, Sub graphs, Walk, Trail, Path, Cycle, Connected and Disconnected graphs, Weakly Connected and Strongly Connected, Components, Complement of Graph, Partition , Decomposition.

UNIT-II: Eulerian and Hamiltonian Graph and Graph coloring

Operation on graphs, Definition of Euler Trail, Euler graph, Standard theorems on Euler graphs Hamiltonian Path, Hamiltonian Cycle and Hamiltonian Graph, Standard theorems on Hamiltonian Graph, Planar graph, Detection of Planarity, Geometric dual, Euler formula, 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 set, Max flow Min cut theorem.

UNIT-III: Trees and algorithms

Trees, Spanning Tree, Distance, Center, Radius, Rank nullity, Spanning trees, Rooted and binary tree, Binary tree in search procedure, Sorting, Depth-First Search(DFS), Breadth-First Search(BFS), Prefix codes , Weighted trees, Matrix representation, Incidence matrix, Circuit matrix, Fundamental circuit matrix, Cut set matrix, Adjacency matrix, Path matrix.

UNIT-IV: Algorithms

Introduction, Algorithm efficiency, In order and Post Order Algorithms, Minimal spanning tree algorithm-Kruskal algorithm, Prims algorithm, Shortest path algorithm- Dijikstra's algorithm, Warshall– Floyd's algorithm, Algorithm for connectedness and components, Travelling Salesman problem (TSP), Algorithm for TSP (to find Hamilton Circuit).

RECOMMENDED LEARNING RESOURCES:

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

REFERENCES:

1. Frank Harary, "Graph Theory", Narosa,2013.
2. J.A Bondy and U.S.R Murthy, Graph Theory with applications, Macmillan,2013
3. GeirAgnarsson and Raymond Geenlaw ; Graph Theory modeling, Applications and algorithms, Pearson Education,2007.
4. Douglas B, "Introduction to Graph Theory",Prentice Hall of India, 2nd edition, 2015.

Course Code	Course Title	Duration (Weeks)	L	T	P	C	Hrs./ Wk.
BTCS15F4200	Engineering Mathematics – IV	14	2	1	0	3	4

Course Objectives:

The objectives of the course are to:

To study and understand the application approach of the concepts of Numerical methods, optimization Techniques, Fourier series and transforms and Queuing theory models in various fields of engineering.

Course Outcomes:

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

1. To understand the basics of numerical methods.
2. To understand the basics of numerical applications.
3. To solve problems in OR and learn the concept of optimization.
4. To apply the concept of Fourier Transforms and Fourier Series and Queuing Theory concepts in various fields of Engineering.

CO PO & PSO MAPPING:

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

COURSE CONTENTS:

Unit –I: Numerical Methods –III:
(i) Numerical solution of simultaneous first order ODE: Picard's and Runge-Kutta method of fourth order.
(ii) Numerical solution of second order ordinary differential equations, Picards method, Runge-Kutta method and Milne's method
(iii) Numerical solutions of PDE: Finite difference approximations to derivatives, Numerical solution of two – dimensional Laplace equation, one-dimensional Heat and Wave Equations

Unit-II :Optimization :
Introduction: linear programming, mathematical formulation of LPP, Graphical Method, Simplex method, BigM-method.

Unit –III:
Fourier series and Transforms: Periodic functions, Dirichlet's conditions and Fourier series of period functions ofperiod 2 and arbitrary period, half range Fourier series, Complex form of Fourier series and Practical Harmonic analysis. Infinite Fourier Transform, Fourier sine and cosine transforms, properties, inversetransforms.

Unit-IV:
Queuing theory: Queue description, characteristics of a queuing model, study state solutions of M/M/1: a Model, M/M/1; N Model, M/M/C: Model, M/M/C: N Model Case studies

RECOMMENDED LEARNING RESOURCES:

1. B.S.Grewal,"Higher Engineering Mathematics",KhannaPublishers,43nd edition,2015.
2. Erwin Kreyszig,"Advanced Engineering Mathematics",WileyPublications,10th edition, 2015.
3. Hamdy A.Taha,"Operations Research-An Inroduction",Dorling KindersIyPvt.Ltd,Pearson edition, 2014

REFERENCES:

1. B.V.Ramana,"Higher Engineering Mathematics",Tata McGraw Hill Publications,19th edition,2013.
2. R.K.JainandS.R.K.Iyengar,"Advanced Engineering Mathematics",Narosa Publishing House, 5th edition, 2014.J.K.Sharma, "Operations Research- Theory and Applications", Macmillan Publications India Ltd, Fifth Edition, 2013.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4300	Design and Analysis of Algorithms	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. To understand methods for analyzing the efficiency and correctness of algorithms (such as exchange algorithms, recurrence, induction and average case analysis).
3. To design algorithms using the dynamic programming, greedy method, backtracking, branch and bound strategy and recite algorithms that employ this strategy.
4. To compare, contrast and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
5. To identify and analyze criteria and specifications appropriate to new problems.

COURSE OUTCOMES:

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

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Apply the algorithms and design techniques to solve problems.
3. Analyze the complexities of various problems in different domains.
4. Analyze best case, average and worst-case running times of algorithms using asymptotic analysis.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction: Notion of Algorithm; Review of Asymptotic Notations; Mathematical Analysis of Non- Recursive and Recursive Algorithms Brute Force Approaches: Introduction; Selection Sort and Bubble Sort; Sequential Search and Brute Force String Matching

Unit –II:

Divide And Conquer And The Greedy Method: Divide and Conquer - General Method; Binary Search; Merge

Sort; Quick Sort and its performance; Greedy Method - The General Method; Knapsack Problem; Minimum-Cost Spanning Trees: Prim's Algorithm; Kruskal's Algorithm; Single Source Shortest Paths.

Unit- III:

Dynamic Programming And Decrease-And-Conquer: Dynamic Programming - The General Method; Warshall's Algorithm; Floyd's Algorithm for the All-Pairs Shortest Paths Problem; Single-Source Shortest Paths: General Weights; 0/1 Knapsack. Decrease-and-Conquer Approaches - Introduction; Insertion Sort; Depth First Search and Breadth First Search; Topological Sorting

Unit –IV:

Space-Time Tradeoffs And Coping With Limitations Of Algorithmic Power: Space-Time Tradeoffs - Introduction; Sorting by Counting; Input Enhancement in String Matching; Decision Trees; P; NP; and NP-Complete Problems; coping with limitations of algorithmic power – Backtracking - n - Queens problem; Hamiltonian Circuit Problem; Subset – Sum Problem; Branch-and-Bound - Assignment Problem; Knapsack Problem; Traveling Salesperson Problem

RECOMMENDED LEARNING RESOURCES:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 2nd Edition, Pearson Education,2007.
2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest and Clifford Stein, Introduction to Algorithms, 3rdEdition, PHI,2010.
3. R C T Lee, S S Tseng, R C Chang andY T Tsai, Introduction to the Design and Analysis of Algorithms A Strategic Approach, Tata McGraw Hill,2005.
4. Jon Kleinbergand E. Tardos, Algorithm Design, Pearson Addison-Wesley,2004.
5. S. Dasgupta, C. Papadimitriou and U. Vazirani Algorithms, 1st Edition, McGraw-Hill Education,2006.
6. AV Aho, JE Hopcroft and JD Ullman, The Design and Analysis of Algorithms, Addison-Wesley Publishing Company,1974.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4400	Microcontrollers	16	HC	2	1	0	3	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide systematic and comprehensive treatment of microcontroller architecture, programming, and interfacing.
2. Provide a strong foundation in the implement of system-level features using hardware and software components of a microcontroller.
3. Provide an understanding of hardware and software aspects of integrating digital peripheral devices (such as memory and I/O interfaces) into microcontroller-based systems;
4. Give the learner a feel of how human and environmental interfaces are provided to a microcontroller-based system.
5. Exposed the learner to the tools and techniques used by practicing engineers to design, implement, and debug microcontroller-based systems.

COURSE OUTCOMES:

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

1. Specify, design, prototype and test microcontroller-based embedded systems for real-world control applications.
2. Interface various environmental and human interfaces with microcontrollers.
3. Develop and test assembly language programs for the 8051 microcontroller.
4. Use modern system development tools in the design of a microcontroller-based system.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

8051 microcontroller architecture: Preliminaries of micro-computing, Microcontroller architecture, registers flags, memory organization, stack, special-function registers, serial and parallel ports, counters and timers, serial input/output, interrupts

Unit-II:
8051 microcontroller programming: Addressing modes, complete instruction set, assembly language programming

Unit-III:
8051 microcontroller-based system design: External memory interface, reset and clock circuits, testing the design, software and hardware timing, look-up table access, serial data transfer in various modes

Unit-IV:
8051 Microcontroller applications: Interfacing keyboards, displays, measuring frequency and time, interfacing analog to digital and digital to analog converters, multiple interrupt handling

RECOMMENDED LEARNING RESOURCES:

1. Kenneth J. Ayala, 8051 Microcontroller: Architecture, Programming, and Applications (2nd ed.), Delmar Thomson Course,1999.
2. Muhammed Ali Mazidi and Janice GillispieMazidi, the 8051 Microcontroller and Embedded Systems (1st ed.), Prentice Hall PTR, Upper Saddle River, NJ, USA,1999.
3. David Calcutt, Frederick Cowan and Hassan Parchizadeh, 8051 Microcontroller: An Applications Based Introduction, Elsevier,2004.
4. Scott MacKenzie, the 8051 Microcontroller (3rd ed.), Prentice Hall PTR, Upper Saddle River, NJ, USA, 1998.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4500	Finite Automata and Formal Languages	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce theory of automata and formal languages.
2. Prove or disprove theorems in automata theory using its properties.
3. Design grammars and recognizers for different formal languages.
4. Provide the basic knowledge and skills required to design and implement compilers.

COURSE OUTCOMES:

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

1. Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
2. Explain and manipulate the different concepts in automata theory and formal languages Have a clear understanding about the equivalence between deterministic and non-deterministic finite automata; and regular expressions.
3. Design automata; regular expressions and context-free grammars for accepting or generating a certain language.
4. Describe the language accepted by an automata or generated by a regular expression or a context- free grammar.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit- I:

Introduction to finite automata: Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon) and their applications.

Unit- II:

Regular Expressions and languages: Regular Expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions; Algebraic laws of regular expression

Unit – III:

Properties of regular languages and context free Grammar: Pumping lemma for regular languages; Closure

properties of regular languages; Decision properties of Regular languages; Equivalence and Minimization of Finite Automata; Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Applications of Context Free Grammars

Unit- IV:

Push down automata: Push down automata (PDA); Languages of a PDA; Equivalence of PDA's and CFG's; Properties of Context Free Languages; Normal Forms(CNF;GNF) for Context Free Grammars; Pumping lemma for CFL's; Closure properties of CFL; Decision properties of CFL's

RECOMMENDED LEARNING RESOURCES:

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

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4600	System Software	16	HC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide the architecture of SIC and SIC/XE machine to build the concepts of SystemSoftware.
2. Provide the function of various system software: assemblers; loaders and linkers, and macro processors.
3. Describe the structure of various system software: assemblers, loaders and linkers, and macro processors.
4. Provide the design concepts of system software, such as assemblers, loaders, linkers and macro processors.

COURSE OUTCOMES:

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

1. Write SIC and SIC/Xe programs.
2. Assemble SIC and SIC/Xe programs.
3. Design and develop an one-pass /two-pass/multi-pass assembler for any machine.
4. Design and develop different type of loaders and linkers.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit- I:

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- II:

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- III:

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- IV:

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

RECOMMENDED COURSE RESOURCES:

1. Leland L Beck, *System Software,* 3rd Edition, Pearson Education, 1997.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4700	Design and Analysis of Algorithms Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Understand methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments; recurrence; induction; and average case analysis.
3. Design algorithms using the dynamic programming; greedy method; Backtracking; Branch and Bound strategy; and recite algorithms that employ this strategy.
4. Compare; contrast; and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
5. Identify and analyze criteria and specifications appropriate to new problems.

COURSE OUTCOMES:

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

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Apply the algorithms and design techniques to solve problems.
3. Analyze the complexities of various problems in different domains.
4. Analyze best case, average and worst-case running times of algorithms using asymptotic analysis.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1 The symbol table is one of the data structures used by an assembler. The structure of symbol table usually consists of three fields they are symbol, symbol value and flags. During pass 1 of assembler, the symbol is first searched in the symbol table. If not found, it will be inserted in to the symbol table else, the assembler mark it as duplicate symbol. During pass 2 of assembler, the symbols encountered in operand field will be searched in the symbol table. If found, the value of that symbol is retrieved. If not found, the assembler generates the error message. Write a C program for the implementation of symbol table with functions to

create, insert, modify, search and display.

2 An assembler is system software which converts assembly language program to machine language program. Based on number of passes it conducts over source program, there are different types of assemblers such as one pass, two pass, and multi pass etc. Among all these the most commonly used assembler is two pass assembler. During pass 1, the assembler scans every source program statement and performs address assignment using location counter variable. During this process, the symbol encountered in the label field will be inserted in to the symbol table. It also performs some processing of assembler directives such as RESW, RESB to find the length of data areas for assigning the address values. Finally it generates the intermediate file as an output. Write a C program to perform the above listed functions during pass 1.

3. For two pass assembler, the actual object code generation takes place during pass 2. The assembler scans the intermediate file line by line. For every mnemonic opcode encountered in the opcode field of instruction, the corresponding machine equivalents are retrieved by the opcode table. For the symbols encountered in the operand field of instruction, their values are fetched from the symbol table. The assembler then assembles the instruction using the appropriate instruction formats. If the opcodes encountered are BYTE and WORD, it generates the data constants as object codes. The generated object codes are written in to object program which contains header, text and end records. Implement the above functions using C.

4. A Macro represents a commonly used group of statements in the source/assembly programming language. The macro processor replaces each macro invocation (macro call) with the corresponding group of source language statements. This is called macro expansion. The one pass macro processor uses three different data structures. They are DEFTAB (Definition table), NAMTAB (Name table) and ARGTAB (Argument table). The DEFTAB holds the macro definition. The beginning and end of the macro definition are marked by two directives MACRO and MEND respectively. The NAMTAB holds name of the macro and pointers to beginning and end of the macro. The ARGTAB holds the arguments listed in the macro call. The student has to write a C program to process the SIC or SIC/XE source program involving macro instructions and one or more macro calls to those instructions and finally to generate the expanded file.

5 A loader is a system program which loads the object program in to main memory for execution. The ope absolute loader is very simple. The object code is loaded to specified locations in the memory. At the loader jumps control to the specified address to begin execution of the loaded program. The advantage of loader is simple and efficient. Write a C program to load the given object program to the specified starting in the main memory.

6 Program relocation is the object program that will be loaded into main memory wherever there is room folder which performs this is called relocating loader. The actual starting address of the object program known until load time. Relocation provides the efficient sharing of the machine with larger memory a several independent programs are to be run together.
Implement a relocating loader using C.

COURSE CONTENTS:

1. Design an algorithm to sort a given set of elements using the Quick sort technique and implement the same to perform Empirical Analysis for different values of n; the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements must be read from a file OR the student is expected to apply random number generator concept to supply the input to the program.

2. Develop an algorithm for the given Directed Acyclic Graph to achieve the following:
   a. Compute all the nodes that are reachable from source node using BFS method.
   b. Analyze whether a given graph is connected or not using DFS method.
3. Construct a Minimum Cost Spanning Tree for a given undirected graph using Kruskal's and Prim's algorithm and perform the empirical analysis on them. Also compare the order of their growths and prepare a report on the same.
4. Evaluate a given node in a weighted connected graph and find all the shortest paths to other nodes using Dijkstra's algorithm.

5. a. Implement All-Pairs Shortest Paths Problem using Floyd's Algorithm.
   b. Implement 0/1 Knapsack problem using Dynamic Programming algorithm.

6. a. Obtain the Topological ordering of vertices in a given digraph.
   b. Compute the transitive closure of a given directed graph using Warshall's algorithm.

7. Deduce an optimal solution for the Traveling Salesperson problem. Also apply error approximation algorithm to determine the error in the instances. The student is free to use either dynamic programming concept OR brute force OR backtracking technique to derive optimal solution.

8. Find a subset of a given set $S = \{s1; s2; \ldots\ldots\ldots\ldots; sn\}$ of n positive integers whose sum is equal to a given positive integer d. For example; if $S = \{1; 2; 5; 6; 8\}$ and $d = 9$ there are two solutions {1;2;6} and {1;8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.

9. Implement String matching algorithm using brute force; Horspool's Method and Knuth-Morris- Pratt. Perform Empirical Analysis for all the three algorithms for the limited set of Strings and compare their outcomes and document the same.

10. Implement *N* Queen's problem using Back Tracking and display the results in the form of a table showing all possible placements of *N* Queens for some instances of *n*.

RECOMMENDED LEARNING RESOURCES:

1. Cormen, T. H., Leiserson, C. E., and Rivest, R. L., C. Stein, *Introduction to Algorithms*, 3rd edition, The MIT Press, Cambridge, MA,2001.
2. Jon Kleinbergand E. Tardos, *Algorithm Design*, Pearson Addison-Wesley,2004.
3. S. Dasgupta, C. Papadimitriou and U. Vazirani Algorithms, 1st edition McGraw-Hill Education,2006.
4. A V Aho, JE Hopcroft and JD Ullman, *Design and Analysis of Algorithms*, Addison-Wesley Publishing Company,1974

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F4800	Microcontrollers Lab	16	HC	0	0	2	2	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide hands-on exposure to microcontroller architecture, programming, and interfacing.
2. Provide a strong foundation in the implementation of system-level features using hardware and software components of a microcontroller.
3. Provide hands-on exposure to human and environmental interfaces to a microcontroller-based system.
4. Exposed the learner to the tools and techniques used by practicing engineers to design, implement, and debug microcontroller-based systems.

COURSE OUTCOMES:

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

1. Specify, design, prototype and test microcontroller-based embedded systems for real-world control applications.
2. Interface various environmental and human interfaces with microcontrollers.
3. Develop and test assembly language programs for the 8051 microcontroller.
4. Use modern system development tools in the design of a microcontroller-based system.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1 Build an assembly language program for 8051 microcontrollers to add, subtract, multiply and divide 8-bit numbers.

2 Develop an assembly language program for 8051 microcontrollers to transfer a block of (n= 10 bytes) data from location 1000H to location 1050H.

3 Create an assembly language program for 8051 microcontrollers to sort a given list of n= 6 bytes of data in ascending or descending order stored from location 9000H in external memory using bubble sort algorithm.

4 Compose an assembly language program for 8051 microcontrollers to determine the largest or the smallest numbers in a list of n= 6 bytes at location 4000H and store the largest / smallest element at location 4062H.

5	Construct an assembly language program for 8051 microcontrollers to add 10 BCD numbers stored in successive memory locations starting from 20H in internal RAM locations and store the result at address 40H (lower significant byte) and 41H (higher significant byte).
6	Make up a C program for 8051 microcontrollers to implement two-bit binary counter through port 2's pin P2.4 and P2.5. Interface the output on LEDs to show the realization.
7	Originate a C program to interface 7-segment display to 8051 microcontrollers. Create a decimal up counter to count from 00 to 99 at an update interval of 1 second.
8	Design an interface to connect a 4x4 matrix keypad to 8051 microcontrollers. Plan a C program such that the keys pressed on the keypad are displayed on the 7-Segment display.
9	Invent an interface to control a stepper motor through 8051 microcontroller. Compile a C Program torotate the stepper motor clockwise and torotate anticlockwise after an issue of external interrupt at $\overline{\text{INT0}}$ pin.
10	Device an interface to attach a digital to analog converter to 8051 microcontroller. Develop a C program to generate a sinusoidal wave and display it on the CRO.
11 a)	C program to reads an analog input and prints the voltage to the Serial Monitor using Arduino Uno board.
	C program to implement an LED bar graph using Arduino Uno board.
12 a)	C program to control the position of a servo (DC motor) with a potentiometer on Intel Galileo board.
	C program to use a pushbutton to control an LED using Intel Galileo board.

RECOMMENDED LEARNING RESOURCES:

1. Kenneth J. Ayala, *8051 Microcontroller: Architecture, Programming, and Applications* (2nd ed.), Delmar Thomson Course,1999.
2. Muhammed Ali Mazid i and Janice GillispieMazidi, *The 8051 Microcontroller and Embedded Systems* (1st ed.), Prentice Hall PTR, Upper Saddle River, NJ, USA, 1999.
3. David Calcutt, Frederick Cowan and Hassan Parchizadeh, *8051 Microcontroller: An Applications Based Introduction*, Elsevier,2004.
4. Scott MacKenzie, *The 8051 Microcontroller* (3rd ed.), Prentice Hall PTR, Upper Saddle River, NJ, USA,1998.

III year Detailed Syllabus

V Semester Syllabus

FIFTH SEMESTER

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5100	Operating System and Unix Internals	16	HC	3	0	0	3	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the history, basics and structure of Operating System.
2. Describe process concepts and scheduling techniques.
3. Familiarize with physical and virtual memory management techniques.
4. Describe UNIX kernel, data structures and internal representation of files in UNIX operating system.
5. Illustrate Interproces communication mechanisms.

COURSE OUTCOMES:

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

1. Explain the history, basics and structure of operating systems.
2. Implement various process management and scheduling schemes.
3. Design and develop memory management techniques.
4. Demonstrate the internals of UNIX operating system.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Operating System Principles: Evolution of Operating Systems, Structural overview, Types of Operating System and operations, Computing environments, Operating System Services, User - Operating System interface, System calls and system programs, Operating System structure, Virtual machines.

Unit – II:

Process Management: Process concept, process scheduling, Operations on processes, Inter process communication. Multi-Threaded Programming, Overview, Multithreading models, Thread Libraries, threading issues. Process scheduling: Basic concepts, scheduling criteria, Scheduling algorithms, Multiple Processor scheduling Thread scheduling.

Unit – III:

Memory Management: Memory Management Strategies, Swapping, contiguous memory allocation, Paging, structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, copy-on-write, Page replacement, Allocation methods, Thrashing.

Unit – IV:

UNIX kernel and its files: Introduction to Kernel: Architecture of the UNIX operating system, Introduction to system concepts, Kernel data structures, System Administration, Internal representation of Files: Inodes, structure of a regular file, Directories, Conversion of a path Name to an Inode, Super block, Inode assignment toa new file, Allocation of disk blocks, other file types.

RECOMMENDED LEARNING RESOURCES:

1. Abraham Silberschatz, Peter Bear Galvin, Greg Gagne, Operating System Principles, Wiley Asia StudentEdition2009.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India, seventh edition 2011.
3. Maurice J. Bach ; The Design of the UNIX Operating System; Pearson Education; Prentice Hall of ndia,2004.

REFERENCES:

1.D. M. Dhamdhere; Operating Systems: A Concept-Based Approach; Tata McGraw-Hill,2002.

2. Charles Crowley; Operating System: A Design-oriented Approach; Irwin Publishing,2002.

3. Gary J. Nutt; Operating Systems: A Modern Perspective; Addison-Wesley,2011.

4. Springer, Springer transaction for advance in Distributed computing and middleware.

5. IEEE, IEEE transaction for Real time operating system.

6. ACM, ACM transaction for embedded operating system.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5200	Object Oriented Programming using C++	16	HC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the basic concepts for defining classes with data and member functions.
2. Familiarize with object creation and accessing members.
3. Explain overloading operations and inheritance mechanisms.
4. Describe the concept of virtual functions and file I/O operations.
5. Illustrate templates and exception handling mechanisms.

COURSE OUTCOMES:

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

1. Implement classes and objects for a given problem.
2. Demonstrate the ability of accessing members in the written programs.
3. Use operator overloading and inheritance mechanism for larger modules.
4. Identify the usage of virtual functions in programs.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction: Overview of C++, 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, The scope resolution operator, Static Class members. Introduction to Objects, Array of Objects, Dynamic Objects, Pointers to objects, Friend Function.

Unit – II:

Operator overloading: Generic functions and classes, Operator overloading using Friend function, overloading special operators, Copy constructor.

Inheritance: Base Class, Inheritance and Protected members, inheriting multiple base classes, Constructors, Destructors and Inheritance, Granting access, Virtual base classes.

Unit – III:

Virtual functions and Polymorphism: Virtual functions, Pure virtual functions, Early and late binding.

Templates and Exception handling: Template Functions, Template Classes, Fundamentals of Exception handling, Handling derived class exceptions, Exception handling options.

Unit – IV:

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, <fstream> and File classes, File operations,

Unformatted and Binary I/O.

RECOMMENDED LEARNING RESOURCES:

1. Herbert Schildt:The Complete Reference C++,4th Edition, Tata McGraw Hill,2003.

2. SanleyB. Lippmann, Josee Lajore: C++ Primer,4th Edition, Pearson Education,2005.

REFERENCES:

1. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education,2009.
2. KR Venugopal,Rajkumar Buyya,Travi Shankar:Mastering C++,Tata McGraw Hill,1999.
3. ACM, ACM Transactions on Programming Languages and Systems(TOPLAS).

LAB EXPERIMENTS:

1. Develop a C++ program for a ***vending machine*** which delivers required soft drinks when inserted a coin. After inserting a coin and confirming your choice on the type of drink, if a coin is in, a drink popsout.
    - Identify the set of variables that will represent the State of the machine.
    - Identify the set of functions that will represent the functions available to the user.
    - Let's assume infinite supply of drinks from the machine.
    - Let's also assume that the machine has capacity to hold infinite coins.

   Note: Student should identify the classes, data and function members in each class to implement all above listed operations. Also identify the appropriate data structures for data members in each class.

2. Develop a C++ program for a ***Banking System*** that carries out following operations.
    - Create an account for a new customer
    - Deposit the money to a given account
    - Withdraw the money from the given account
    - Classify and list the transactions of theday.
    - Transfer the money from one account to another.
    - Balance Enquiry.
    - Print mini statement.

Note: Student should identify the classes, data and function members in each class to implement all above listed operations.

3. Develop a C++ program to buy candy from a machine. The machine sells candies, chips, gum, and cookies. The program should perform the following operations:
    - Show the customer the different products sold by the candy machine.
    - Let the customer make the selection.
    - Show the customer the cost of the item selected.
    - Accept money from the customer.
    - Release the item.

   Note: Students should define two classes, Cash Register and Dispenser Type. Identify data andfunction members in each class to perform the above listed operations.

4. Develop a C++ program to create an ecommerce website similar to Flipkart/Amazon/Big basket which contains items of type grocery, clothing and electronics. Provide a cart to various items with quantity. If the item is not required, the user can remove the item from cart. Use operator overloading concepts for adding, removing items and generate a bill. Categorize and display the bill depending on the category.

5. A student studying in a university wants to store some of his details in a file .Data are Volatile and prone to change. In order t o perform the above said task he can use files to store the data and also rewrite a file if any updates using different file operations. Develop a C++ program to illustrate the write () member function for transfer of data blocks to the file.

6. Develop Object Motion Tracking systems there is a need to use matrix operations. Hence define a class Matrix with data function members to perform the following operations.

- Initialization of matrices using constructors.
- Addition of matrices using operator overloading.
- Subtraction of matrices using operator overloading.
- Multiplication of matrices using operator overloading.

7. Create a class template for performing stack operations. Write following function templates as members of class template.
   - A function template to push an element into the stack.
   - A function template to pop an element from the stack.
   - A function template for displaying elements.

   Develop a C++ program to perform the above mentioned tasks.

8. A famous Industrialist had a difficult childhood. Instead of playing with ball and bat he started playing with money. He moved to Dubai at the age of 15 in search of a job. He started his career as a fuel pump worker, who later became a business Tycoon in fuel industry. He also started the textile business, later his son's Anil and Mukesh took on the business and stated Reliance communication and reliance infrastructure respectively. They are finding difficulties in paying the tax. Develop a C++ program to calculate tax with the following taxation.
   - Fuel business is with tax of15%
   - Textile business with12%
   - Reliance communication with16%
   - Infrastructure business with18%

   Note: Suitable assumptions with justification must be done
   - Execute the program.
   - Use files to store data.

   Use manipulators for displaying output.

9. Government of India wants to have population census for 5 states [Uttar Pradesh, Maharashtra, Bihar, West Bengal, Goa]. Assuming each state has 5 districts. Write a C++ program for below giventasks:-
   - Function for calculating total population of each state.
   - Function for calculating total population of 5states.
   - Display all the details.

10. Package-delivery services, such as FedEx®, DHL® and UPS®, offer a number of different shipping options, each with specific costs associated. Create an inheritance hierarchy to represent various types of packages.Use Package as the base class of the hierarchy, and then include classes Two Day Package and Overnight Package that derive from Package. Base class Package should include data members representing the name, address and city for both the sender and the recipient of the package, in addition to data members that store the weight (in ounces) and cost per ounce to ship the package. Package's constructor should initialize these data members. Ensure that the weight and cost per ounce contain positive values. Package should provide a public member function calculate Cost that returns a double indicating the cost associated with shipping the package. Packages calculate Cost function should determine the cost by multiplying the weight by the cost per ounce. Derived class Two Day Package should inherit the functionality of base class Package, but also include a data member that represents a flat fee that the shipping company charges for two-day-delivery service. Two Day Package's constructor should receive a value to initialize this data member. Two Day Package should *redefine* member function calculate Cost so that it computes the shipping cost by adding the flat fee to the weight-based cost calculated by base class Package's calculate Cost function. Class Overnight Package should inherit directly from class Package and contain an additional data member representing an additional fee per ounce charged for overnight delivery service. Overnight Package should redefine member function calculate cost so that it adds the additional fee per ounce to the standard cost per ounce before calculating the shipping cost.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5300	Database Management System	16	HC	3	0	0	3	3

COURSE OBJECTIVES:

The objectives of the course are to:

1. Provide the basic knowledge about the data models and database concepts.
2. Describe conceptual data models and ER diagrams.
3. Explain theoretical concepts of the relational data model and the relational algebra.
4. Describe the use of SQL commands for database operations.
5. Illustrate database design concepts and normalization with examples.

COURSE OUTCOMES:

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

1. Apply the knowledge to design database schemas.
2. Design ER diagrams for given data models.
3. Use database concepts and relational models for building database applications.
4. Develop database applications for industrial projects.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction to databases and Conceptual Modelling : Introduction, 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.

Unit – II:

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 – III:

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 – IV:

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

RECOMMENDED LEARNING RESOURCES:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill,2003.
2. Elmasri and Navathe, Fundamentals of DatabaseSystems,5th Edition, Pearson Education,2007.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill,2010.
2. CJ Date,Database Design and Relational Theory: Normal Forms and All that Jazz,O'Reilly,April 2012.
3. IEEE, IEEE Transactions on Knowledge and Data Engineering.
4. Elsevier, Elsevier Data and Knowledge Engineering.
5. ACM, ACM Transactions on Database Systems.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5400	Software Ethics and Project Management	16	HC	3	0	0	0	3

Course Objectives:

The objectives of this course are to:

1. Describe computer ethical theories and intellectual property rights.
2. Explain ethical, professional issues and coding principles.
3. Impart the knowledge about the intricacies of storage and accessibility issues.
4. Introduce the safety and risk analysis in computing environment.
5. Explore the concepts of software project management.

Course Outcomes:

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

1. Practice the ethics and usage of intellectual property rights.
2. Comply with issues in developing computing models.
3. Use the knowledge for developing content that will be stored and accessed with internet regulations.
4. Carry out software version management, and justify the project monitoring and evaluation.

CO PO & PSO MAPPING:

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	3	3	3
CO2	3	3	3	2	3	-	-	-	-	3	-	3	3	-	3
CO3	2	2	3	3	2	-	-	-	-	-	-	3	3	-	3
CO4	3	3	1	2	1	-	-	-	3	-	-	3	-	3	3

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

COURSE CONTENTS:

Unit – I:

Computer Ethics, Intellectual Property Rights: Introduction: Identifying an ethical issue, Ethics and law, Ethical theories, Professional Code of conduct, A framework for ethical decision making, the nature of Intellectual property, Intellectual Property, Patents, Trademarks, Trade Secrets, Software Issues, the extent and nature of software piracy, Ethical and professional issues.

Unit – II:

Regulating internet content, technology and safety : Introduction, Censorship, Laws upholding free speech, Free speech and the Internet, Ethical and professional issues, Internet technologies and privacy, Safety and risk assessment, risk benefit analysis, reducing risk, Principle of equal access, Obstacles to access for individuals, professional responsibility.

Unit –III:

Project management, project evaluation: Introduction: Project, Contract Management, Activities Covered By Software Project Management, Plans, Methods and Methodologies , Management and Management Control, Cost Benefit Evaluation Techniques, Risk Evaluation.

Unit –IV:

Activity planning, monitoring and control: Project Schedule, Sequencing and Scheduling Activities, Network

Planning Models, Forward Pass, Backward Pass, Activity Float, and Shortening Project Duration.
Networks, Risk Management, Types of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning and Control. Creating Framework, Collecting The Data, Visualizing Progress, Cost Monitoring, Earned Value, Getting Project Back To Target.

RECOMMENDED LEARNING RESOURCES:

1. Penny Duquenoy,Simon Jones and Barry G Blundell,"Ethical,legal and professional issues in computing",Middles ex University Press,2008.
2. George Reynolds,"Ethics in Information Technology",Cengage Learning,2011.

REFERENCES:

1. Bob Hughes,Mikecotterell,"Software Project Management",Third Edition,Tata Mc Graw Hill,2004.
2. IEEE transactions on Software engineering.
3. ACM transaction on Project management.
4. ACM transaction on Software engineering.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5500	Computer Network Concepts and Protocols	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the concept of Protocol Stacks (OSI and TCP/IP), data communication with packet switching and virtual circuitnet works.
2. Give knowledge about network topologies and Ethernet standards.
3. Explain various media access techniques, error detection and correction mechanisms.
4. Familiarize the students with routing and error reporting protocols.
5. Gain expertise in transport layer and application layer standards and protocols.

COURSE OUTCOMES:

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

1. Use protocol stacks (OSI and TCP/IP) for developing data communication applications.
2. Apply error detection & correction strategies for data transmission.
3. Establish network of computing devices using topology and Ethernet standards.
4. Experiment routing protocols and error reporting protocols.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction to Data Communication and Networking: Internet history and Internet today, Data Communications, Networks, Protocols & Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing. Introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.(Ch.1.1,1.2,1.3,1.4, 21,2.2, 2.3,2.4,2.5,8.1, 8.2,8.3)

Unit – II:

Concepts of Multiplexing, FDM, WDM, TDM, Line coding methods, Digital Modulation techniques, **Networking Devices:** Digital Subscriber Line Modems, Cable Modems, Repeaters, Hubs, Bridges, Routers, and High layered switches, Gateways.

Error Detection and Correction: Introduction, cyclic Codes: Cyclic redundancy code generation for checksum. Frames, Packets, Point-to-Point Protocol, CSMA/CD, CSMA/CA, Controlled Access: Reservation, Polling, Token passing. (Ch. 3.1, 3.2, 3.3, 10.1, 10.2, 10.3, 10.4, 10.5)

Unit-III:

Network Topologies, Classification of Networks, Protocols, PPP, IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, IEEE 802.11, Architecture, MAC Sublayer, Addressing Mechanism. IPv4 addresses, IPv6 addresses, transition from IPv4 to IPv6. ((Ch. 13.1, 13.2, 13.4, 13.5, 14.1, 14.4, 19.1,19.2, 20.1, 20.2, 20.3, 20.4).

Unit-IV:

Standards and Protocols: User Datagram Protocol (UDP): UDP Segment, Transmission Control Protocol (TCP): TCP Segment, Connection Set up, Application of TCP and UDP. TCP Congestion Control.

Domain Name System (DNS): Name/Address Mapping, DNS Message Format. Remote Login Protocols: TELNET Protocol and SSH Protocol. Electronic Mail (E-Mail), World Wide Web (WWW).

Basic concepts of FTP, GSM, LTE, MPLS, VPN, ATM, Bluetooth. WiFi, WiMax. (Ch. 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 2.4, 6.2, 6.3, 6.6)

RECOMMENDED LEARNING RESOURCES:

1. Behrouz A Forouzan: Data Communications and Networking, 4th Edition, McGraw – Hill,2006.
2. Nader F. Mir: Computer and Communication Networks, Pearson Education,2009.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F5610	Electronic System Design	16	SC	3	0	0	3	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide strong foundation of diode theory and its various applications like clippers, clampers and rectifiers.
2. Impart the knowledge about the different types of transistor and its various applications like amplifiers, sensors and logarithmic converters.
3. Describe Operational amplifiers types and its various applications like amplifiers, ADC, comparators, regulators and filters.
4. Introduce the case studies such as complete power supply and triangular waveform using schimitt trigger and integrator.

COURSE OUTCOMES:

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

1. Design and implement diode based clipping, clamping and rectifier circuits.
2. Employ transistor and Opamp based circuits in real time applications.
3. Use Opamps in electronic systems for developing various applications like amplifiers, ADC, Comparators, regulators and filters.
4. Apply the knowledge obtained from case studies for developing new applications.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:
Diode circuits and its applications: Diode basics, Load Line Analysis, Clippers, Clampers, Half Wave Rectifier and Full wave Rectifiers, Peak detector, LED circuit, Voltage reference, and Power conversion.

Unit – II:
Transistor and its applications: Bipolar Junction Transistors(BJT Version), PNP and NPN transistors, Field Effect Transistors, MOSFETs, Coupling circuits, Grounding, Transistor as an Amplifier, Switch, high speed digital logic(ECL),Temperature Sensors, Logarithmic converters.

Unit – III:

Operational Amplifiers and its applications: Opamp Basics, Opamp circuits-Differential amplifier, instrumentation amplifier, Oscillator (Wien Bridge Oscillator), Active filters, Comparators, Precision rectifiers, voltage and current regulators, analog to digital converters.

Unit – IV:

Electronic Systems: Introduction, Block diagram of simple electronic System, Types of Electronic System, interconnection of systems, Electronic feedback systems**.**

Case study 1: Complete power supply

Case study 2: Triangular waveform using Schmitt trigger and Integrator

RECOMMENDED LEARNING RESOURCES:

1. Robert L. Boylestad and Louis Nashelsky,"Electronic Devices and Circuit Theory",10th edition PHI/Pearson Education.2009.

2. Milliman Halkias,"Electronic Devices and Circuits",MGH,1967

3. Anil K Maini, VarshaAgarwal: Electronic Devices and Circuits, Wiley,2009.

REFERENCES:

1. David A.Bell,"Electronic Devices & Circuits",IV Edition,Prentice Hall of India/Pearson Education, ninth printing,2007.

2. Jacob Millman& Christos.C.Halkias,SatyabrataJit,"Electronic Devices and Circuits", 2nd edition Tata McGraw Hill,2008.

3. Dennis Eggleston,"Basic Electronics for Scientists and Engineers", Cambridge Press,2011.

4. http://www.electronics-tutorials.ws/systems/electronic-system.html

5. Journal of Computational Intelligence and Electronic Systems

6. IETE Journal of Research

7. Springer, Journal of Electronic Testing: Theory and Applications.

8. Springer, Microelectronics Journal

9. IEEE, International Journal of Highly Reliable Electronic System Design(HRESD)

10. IEEE, Aerospace and Electronic System Magazine

11. IEEE, IEEE Transactions on Circuits and Systems Magazine

12. ACM, ACM Transactions on Design Automation of Electronic Systems

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F5620	Signals and Systems	**16**	**SC**	**3**	**0**	**0**	**3**	**3**

COURSE OBJECTIVES:

The objectives of this course are to

1. Impart the knowledge about Continuous and Discrete-time signals and systems, their properties and representations.
2. Describe the differential and difference equations, impulse response and convolution using the knowledge of time-domain representation of a signal.
3. Introduce Fourier Transform, their properties, applications and representation of signals.
4. Explain sampling theorem and Nyquistrate.
5. Illustrate mathematical and computational skills needed in application areas like communication, signal processing etc.

COURSE OUTCOMES:

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

1. Analyze the properties of Continuous-Time and Discrete-Time signals and systems.
2. Appraise the role of convolution in the analysis of linear time invariant systems and use convolution to determine the response of linear systems to arbitrary inputs.
3. Use Fourier transform for representing and analyzing properties of signals.
4. Identify the effects of sampling a Continuous-Time signal.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Classification of Signals and Systems: Definition of a signals and system, classification of signals, basic operations on signals, elementary signals, and systems viewed as interconnections of operations, properties of systems, Time domain representation of LTI system; convolution, impulse response representation; convolution sum, convolution integral.

Unit – II:

Analysis of Linear Time Invariant Systems: Properties of impulse response representation, differential and difference equation representation, Block diagram representation, Fourier representation of signals, Discrete

time and continuous time Fourier series and their properties.

Unit – III:

Fourier Representation for signals: Discrete and continuous Fourier Transform and their properties, Application of Fourier representations, Frequency response of LTI systems, Fourier transforms representation of periodic signals, Fourier transforms representation of discrete time signal, sampling theorem and Nyquist rate.

Unit – IV:

Z-Transforms: Introduction, Z – transform, properties of ROC, properties of Z – transforms inversion of Z – transforms, Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations.

RECOMMENDED LEARNING RESOURCES:

1. Simon Haykins;" Signals and systems ";Johnwiley;India Pvt Ltd;Second Edition;2008.
2. Michael Roberts;" Fundamentals of signals and systems ";TATA McGraw Hill;Second Edition;2010.
3. Ganesh Rao and Satish Tunga;" Signals and Systems ";Pearson/Sanguine Technical Publishers;2004

REFERENCES:

1. Edward W Kamen & Bonnie's Heck; "*Fundamentals of Signals and Systems*"; Pearson Education; Third Edition;2007

2. Allan V.Oppenheim; S.Wilskyand S.H.Nawab ;"Signals and Systems";Pearson Education ;Second Edition; 1997

3. IEEE, IEEE Transactions on Signal Processing

4. Springer, Journal of Signal Processing Systems

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5630	Digital Communication	16	SC	3	0	0	3	3

PREREQUISITES:

Knowledge of Fundamentals of Communication; Probability and Random Process

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the basics of elements of digital communication systems.
2. Provide practical aspects of sampling and signal recovery.
3. Describe digital representation and communication techniques.
4. Gain expertise in error control methodologies.
5. Explain concept of advanced communication systems such as satellite communication, mobile radio etc.

COURSE OUTCOMES:

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

1. Practice the elements of digital communication system, sampling and signal recovery.
2. Develop digital representation and communication techniques.
3. Devise error control methodologies for data communication applications.
4. Analyze different error control coding methods.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Elements of Digital Communication Systems: Model of Digital Communication Systems, Digital Representation of Analog Signal, Certain issues in Digital Transmission, Advantages of Digital Communication Systems, Bandwidth-S/N tradeoff, Hartley Shannon Law, Sampling theorem (Statement), reconstruction of message processes from its samples, signal distortion in sampling, practical aspects of sampling and signal recovery using Sample and Hold circuit for signal recovering.

Unit – II:

Digital Pass band Transmission: Hierarchy of Digital Techniques, Coherent Binary PSK, Coherent Binary FSK, Coherent QPSK, Coherent minimum shift Keying, Non Coherent Binary Phase shift keying, PCM Systems, Noise Considerations in PCM system, Overall Signal-to-noise ratio for PCM system, Virtues, Limitations & Modification of PCM system, QAM.

Unit – III:

Error Control Coding: Introduction; Discrete-Memoryless channels, Linear Block codes, Cyclic Codes, Convolution codes, Maximum Likelihood decoding of convolution codes, Trellis coded Modulation.

Unit –IV:

Advanced Communication: Introduction, Satellite communication, Mobile Radio, OFDM concept, MIMO concept, DVB (Digital Video Broadband) fundamentals, Emerging View of Telecommunications, Spread-spectrum- concepts of Direct-sequence spread spectrum (DSSS) and Frequency Hopping Spread Spectrum(FHSS).

RECOMMENDED LEARNINGRESOURCES:

1. Bernard Sklar;"Digital Communication ;Fundamentals and Application";Pearson Education Asia; 2nd Edition ;2013.
2. Simon Haykin ;John Wiley & Sons;"Communication Systems"; 4th Edition;2000.
3. John G.Proakis;"Digital Communication";McGraw HillInc; 5th Edition;2008.

REFERENCES:

1. Mullet ;"Introduction to Wireless Telecommunications Systems and Networks ",Cengagen Learning, Sixth Indian reprint 2010.
2. Rappaport Theodore "Wireless Communications:Principles and Practice"Pearson Education India, 2012.
3. Dennis Roddy;"Satellite Communications";McGraw HillInc;4th Edition;2009.
4. IEEE, IEEE Transactions on Communications.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5640	Programming Languages and Compilers	16	SC	3	0	0	3	3

COURSE OBJECTIVES:

1. Provide the foundation on the components of structuring data, computation and programs.
2. Describe the principles of functional and logic programming.
3. Explain the lexical analysis and syntax analysis techniques of compiler.
4. Gain expertise in semantic analysis and intermediate code generation.
5. Outline the basics of code optimization theory.

COURSE OUTCOMES:

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

1. Implement data structures, computations and programs.
2. Develop procedure oriented and logic programs.
3. Design and develop lexical and syntax analysis modules.
4. Write programs for intermediate code generation.

CO PO & PSO MAPPING:

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	2	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	3	-	-	-	-	-	-	-	-	-	-

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

COURSE CONTENTS:

Unit – I:
Introduction: Names, Scopes, and Bindings: The art of language design; Programming language spectrum; why study programming languages? Compilation and interpretation; Programming environments. Names, scope, and bindings: The notion of binding time; Object lifetime and storage management; Scope rules; Implementing scope; The meaning of names within a scope; The binding of referencing environments; Macro expansion.
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 – II:
Syntax analysis 1: Context-free grammars, Derivations and syntax trees, Handling ambiguous grammars, Top-down parsing, Bottom-up parsing – SLR()

Unit-III:
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–IV:
Intermediate code generation: Variants of syntax trees; Three-address code; Control flow; back patching;
Code optimization and generation: Basic blocks and Flow graphs; Optimization of basic blocks;

RECOMMENDED LEARNING RESOURCES:

1. A. V. Aho, R. Sethi and J. D. Ullman, *Compilers – Principles, Techniques, and Tools*, Addison-Wesley, Pearson Education,2001.

2. Carlo Ghezzi, and MehdiJazayeri, *Programming Languages Concepts*, 3rd Edition, John Wiley & Sons, 1996.

3. AllenTucker,RobertNonan,*ProgrammingLanguages,PrinciplesandParadigms*,2ndEdition,Tata McGraw-Hill,2007.

4. Terrence W. Pratt and Marvin V. Zelkowitz, *Programming Languages: Design and Implementation*, Pearson Education, Prentice Hall of India,2001.

REFERENCES:

1. Charles N.Fischer,RichardJ.leBlanc,Jr.,*Craftinga Compiler with C*,Pearson Education,1991.

2. Kenneth C Louden, *Compiler Construction Principles &Practice*,Cengage Learning,1997.

3.A.W. Appel, *Modern Compiler Implementation in Java*, Cambridge University Press, 2002.

4. Ravi Sethi, *Programming languages Concepts and Constructs*, 2nd Edition, Pearson Education,1996.

5. R Sebesta, *Concepts of Programming Languages*, 8th Edition, Pearson Education,2008.

6. IEEE, IEEE Transactions on Computers.

7. ACM, ACM Transactions on Programming Languages and Systems(TOPLAS).

8. Elsevier, Computer Languages, Systems and Structures.

9. Springer, Journal of Logic, Language and Information.

LAB EXPERIMENT:

1. Design a lexical analyzer to recognize and classify tokens for a sample C program.
2. Write a C program to test whether a given identifier is valid or not.
3. Write a C program to implement the syntax-directed definition of “if E then S1” and “if E then S1 else S2”.
4. Write a C program that accepts a regular expression as input and produce its parse tree as output.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F5650	Object Oriented Modeling & Design	16	SC	3	0	0	3	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide sound understanding of the software complexity and concepts of the object model.
2. Introduce the concepts of classes and objects and the irrelations.
3. Modelling the problems using class, object and interaction diagrams.
4. Describe realistic applications developed using object-oriented modeling.

COURSE OUTCOMES:

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

1. Appraise the significance of object modeling.
2. Identify the objects and the irrelations.
3. Construct various UML models (including use case diagrams; class diagrams; interaction diagrams; state chart diagrams; activity diagrams; and implementation diagrams) using the appropriate notation.
4. Implement real time applications using the object-oriented modeling and design.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Complexity: The Structure of Complex Systems, The Inherent Complexity of Software, The 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 – II:

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 – III:

The Unified Modeling 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.

Unit – IV:

Applications: Traffic Management**:** Inception, Elaboration, Construction, Post-Transition, Artificial Intelligence: Cryptanalysis, Inception, Elaboration, Construction, Post-Transition, Data Acquisition: Weather Monitoring Station: Inception, Elaboration, Construction, Post-Transition, Web Application: Vacation Tracking System, Inception, Elaboration, Construction, Post-Transition.

RECOMMENDED LEARNING RESOURCES:

1. *G*rady Booch ,Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young ,Jim Conallen Kelli A.Houston , *Object-Oriented Analysis and Design with Applications*(3th ed.), Addison-Wesley , 2007.
2. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML (2nd ed.), Pearson Education,2005.

REFERENCES:

1. Grady Booch, James Rumbaugh, Ivar Jacobson *Unified Modeling Language User Guide,*Addison Wesley, 1998
2. James Rumbaugh, Ivar Jacobson, Grady Booch, *Unified Modeling Language Reference Manual (2nd ed.),* AddisonWesley,2004.
3. IEEE, Remembrance of Things Past.
4. ACM, Case tools in object-oriented analysis and design.
5. Elsevier, Object-Oriented Analysis and Design for Information Systems.
6. Springer, A Theory of Object-Oriented Design.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5700	Operating System Lab	16	HC	0	0	2	2	4

COURSE OBJECTIVES:

The objectives of this Lab are to:

1. Provide the hands on skills on integrated development environment in UNIXOS.
2. Experiment the use of multithreading concepts.
3. Practice Banker's Algorithm and scheduling algorithms.
4. Implement aspects of LRU Algorithm.
5. Develop skills for contributing new computational modules for future OS.

COURSE OUTCOMES:

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

1. Demonstrate the use of integrated development environment in UNIXOS.
2. Construct/build larger industry projects comprising multiple threads for various tasks.
3. Develop deadlock detection/recovery and process scheduling mechanisms for real time systems.
4. Design page replacement methods for new systems.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1. A child process in computing is a process created by another process (the parent process). This technique pertains to multi-tasking operating system and sometimes called a sub-process or subtask. Now, use C language to create a child process to read commands from the standard input and execute them.

2. Fibonacci series is one of the optimal searching techniques. Multi-threaded program is used to execute multiple process or threads concurrently by the central processing unit. Now, run a Multi- threaded program in C to generate and print the Fibonacci series in such a way that one thread has to generate the numbers up to the limit specified by the user and another thread to print them.

3. Producer-Consumer Problem also known as bounded-buffer problem is an example of multi-process synchronization problem. This problem arises when the producer and consumer share a common, fixed size buffer. The solution can be obtained by means of inter –process communication typically using Semaphores. Now, implement a process with a produces thread and a consumer thread which makes use of bounded buffer. Use any suitable synchronization construct. (Implement producer-consumer problem using semaphores).

4. To design and develop CPU Scheduling policies of operating system, it is necessary to develop various modules like, Process Manager, Memory Manager, Input-Output Manager and Network Manager and many

more. The process manager is one of the important modules of OS. It deals with creation and execution of multiple processes sharing the processor time. The process manager uses various scheduling policies. Hence, there is a need to understand the various scheduling policies. Hence**,** given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority. For each of the scheduling policies, compute and print the average waiting time and average turn around time.

5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Round Robin Algorithm. For each of the scheduling policies, compute and print the average waiting time and average turn around time.

6. In multiprogramming environment, several processes execute at the same time sharing the processor time. It is required to understand the performance of the policies FCFS and SJF in proper utilization of CPU time. Therefore write program to compare their performance metrics in terms of average turnaround time, average waiting time and average waited turn around.

7. Consider the dining-Philosophers problem where the chopsticks are placed at the center of the table and any two of them could be used by a philosopher. Assume that requests for chopsticks are made one at a time. Describe a simple rule for determining whether a particular request could be satisfied without causing deadlock given the current allocation of chopsticks to philosophers.

8. Theoperatingsystemmanagesthecomputer'smemory.TheOSallocatesrequiredmemoryforthe task and deallocates memory after execution of task. There are many allocation strategies. Write a C program to simulate the Multi Programming with Variable number of Task (MVT) memory strategy.

9. The operating system replaces the page of a old process whenever a new process page has to be loaded in memory. To select the page for replacement there are many methods. Write a C program to implement LRU page replacement algorithm.

10. The operating system manages storage of information by creating and storing information in the file. There are many methods of creating file. Write a C program to implement any one of the file allocation techniques (Linked, Indexed or Contiguous).

RECOMMENDED LEARNING RESOURCES:

1. Abraham Silberschatz; Peter Bear Galvin; Greg Gagne; Operating System Principles,; Wiley Asia StudentEdition2009.
2. William Stallings; Operating Systems: Internals and Design Principles; Prentice Hall of India, seventh edition2011.
3. Maurice J. Bach ; The Design of the UNIX Operating System; Pearson Education; Prentice Hall of India,2004.

REFERENCES:

1. D. M. Dhamdhere; Operating Systems: A Concept-Based Approach; Tata McGraw-Hill,2002.

2. Charles Crowley; Operating System: A Design-oriented Approach; Irwin Publishing,2002.

3. Gary J. Nutt; Operating Systems: A Modern Perspective; Addison-Wesley,2011.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F5800	Database Management System Lab	16	HC	0	0	2	2	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide hands on skills on creating a database.
2. Demonstrate different operations on database using SQL DML/DDL commands.
3. Identify and illustrate various clauses for different queries.
4. Generate reports as per user requirements.
5. Develop industry standard database applications for various domains.

COURSE OUTCOMES:

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

1. Design and implement a database schema.
2. Use appropriate SQL commands for designing queries.
3. Design and build a GUI application using a front end tool.
4. Design and develop applications like banking, reservation system, etc.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

Exercise 1: 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.

Customer (cid, cname, city, discount)

Agent (aid, aname, city, commission)

Product (pid, pname, city, quantity, price)

Orders (ordno, month, cid, aid, pid, qty, amount)

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 forpid.
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 "NewDelhi".
j) Retrieve names of the customers who have the same discount as that of any (one) of the customers in "Dargeling" or"Bangalore".
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 notexists)
n) Retrieve customer ids whose orders placed through all the agents in "NewDelhi".
o) Retrieve agent ids either from "New Delhi" or "Srinagar" who place orders for ALL products priced over onedollar.
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 least9000.00.
q) Increase the percent commission by 50% for all agents in "NewYork".
r) Retrieve the total quantity that has been placed for each product.

Exercise2: Employee Database System

The storage of digital data is increasing day by day. Every big / small organization started storing their employee details like name, salary, address, department under which they are working in their own database. Design a company database which can store the details of departments, projects, their employee and his / her dependent details of a particular organization.

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)

Queries

a) Retrieve the names of the employees who work on all the projects controlled by dept no3.
b) Retrieve the names of the employees who get 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 atleast one of the project numbers1, 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 work in the same department as that ofRAM.
k) Retrieve the names of the employees whose salary is greater than the salary of all the employees working in department no3.
l) Retrieve the names of the employees who work for dept no 3 and have a daughter as dependent.
m) Retrieve the names of the employees who paid highest salary from each department.
n) Retrieve the names of the employees who are paid the same salary as that of Anil.
o) Retrieve the total the number of employees in the ‘Research’ department.

p) For each project, retrieve the project number, the project name, and the number of employees who work on that project.

Exercise3: Car rental agency database system

The application that can be used for booking a vehicle online from his / her place is very much needed in mobile devices. The main aim of this system is to illustrate a database application for booking vehicles online. Design a car rental agency database which can store customer details, vehicle details like vehicle id, size, transmission and reservation details like who had booked from one date to other.

Customers (cid, firstname, lastname, address)

Vehicle (vid, mileage, location, vsize, transmission)

Reservations (cid, vid, start_date, end_date)

Note :

->Vehicle.transmission can have two values 'manual' and 'automatic'.

->Vehicle.vsizecan have following values.'compact','mid-size','full-size','premium'and'luxury'.The default size is compact.

Queries

a) Display both the first name and last name in uppercase as "Name of the Customer"as column name.
b) Display vehicles size which is having maximum mileage.
c) Find location and total mileage of all vehicles specific to each respective location.
d) Find average mileage of vehicles for each location, which has at least five vehicles.
e) Display the customer names whose reservation start date is before Feb 18th2016.
f) Display the vehicle which has been reserved between the dates Nov 5th 2015 and Jan 16th2016.
g) Display the names of the customers whose last name starts with 'D' and who has reserved more vehicles than the customer with cid as'101'.
h) Retrieve the customers who have reserved vehicles from all the locations.
i) Retrieve the locations that have at least one vehicle with manual transmission that has lower mileage than any luxury vehicle at that location.
j) Delete all the reservations for customer whose last name starts with 'S'.

RECOMMENDED LEARNING RESOURCES:

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. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill,2010.

REFERENCES:

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. IEEE, IEEE Transactions on Knowledge and Data Engineering
4. Elsevier, Elsevier Data and Knowledge Engineering
5. ACM, ACM Transactions on Database Systems

VI Semester Syllabus

SIXTH SEMESTER:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F6100	Software Engineering and Testing	16	HC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the terminologies of software engineering and testing.
2. Explain Professional and ethical responsibilities in software engineering practices.
3. Describe critical systems and software process models.
4. Gain expertise in software requirements documentation and rapid software development strategies.
5. Provide knowledge about software verification and validation.
6. Describe different testing approaches such as Boundary Value Testing, Equivalence Class Testing, Decision Table Based Testing, Path Testing, Data Flow Testing, Path Testing, and Data Flow Testing with real time example for each.

COURSE OUTCOMES:

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

1. Explain the terminologies of software engineering and testing.
2. Develop software requirements documentation for a given problem and use rapid software. development strategies in developing software products.
3. Verify and validate the software systems with functional and nonfunctional requirements.
4. Apply testing methods to detect errors and check the functionality of the system.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Overview; Critical Systems and Software Processes: Introduction: Definition and terminology used in software engineering and software testing, Software engineering, Professional and ethical responsibility Socio-Technical systems: Emergent system properties, Systems engineering, Legacy systems.

Critical Systems: Software Processes, Critical Systems, A simple safety critical system, System dependability, Availability and reliability. Software Processes: Models, Process iteration, Process activities.

Unit –II:

Requirements and Development process: 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, Rapid application development. Software Evolution: Program evolution dynamics, Software maintenance.

Unit – III:

Verification and Validation, A Perspective on Testing, Examples: Verification and Validation: Planning, Software inspections, automated static analysis, Verification and formal methods. Software testing: System testing, Component testing.

A Perspective on Testing, Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudo code, the triangle problem.

Unit – IV:

BVA Testing, Equivalence Class Testing, Decision Table Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, commission problem. Decision tables, Test cases for the triangle problem.

Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing -+-+

RECOMMENDED LEARNING RESOURCES:

1. Ian Sommerville; Software Engineering; 8th Edition; Pearson Education;2007.
2. Roger S Pressman; Software Engineering-A Practitioners approach; 7th Edition; McGraw Hill;2007.
3. ,ACraftsman'sApproach,3rdEdition,Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 1314,15)

REFERENCES:

1. Pankaj Jalote;An Integrated Approach to Software Engineering; 3rd Edition; Narosa Publishing House;2005.
2. Roger S Pressman; Software Engineering-A Practitioners approach; 7th Edition; McGraw Hill;2007.
3. Pratap K J Mohapatra; Software Engineering (A Lifecycle approach); 1st Edition; New Age InternationalPrivate Limited;2010.
4. Springer, Journal of Software Engineering Research and Development.
5. IEEE, IEEE Transaction on software Engineering.
6. ACM Transaction on Automated Software Engineering
7. ACM Transaction on Software Engineering and Methodology.
8. Elsevier, Advances in Engineering software

Lab Experiments:

1. A softball team submit equipment list to their sponsors as cardinals and blue jays. The Quantity of their equipments (bats , balls and gloves) for respective sponsors as cardinals are 12, 45,15 and for Blue jaysare15,38,17.The cost of each equipment(Bat, Balls, Gloves)are 15,38 and 17. At the end both the sponsors wants their amount of contributions. Write a program in C language for formulating the above context, and test the same using boundary value analysis. Introspect the causes for its failure and write down the possible reasons for its failure.
2. A Rifle sales persons in the former Arizona Territory sold rifle locks, stocks and barrels made by a gunsmith in Missouri. Locks cost $45, Stocks cost $30, and barrels cost $25. The salesperson had to sell at-least one complete rifle per month, and production limits were such that the most the salesperson could sell in a month was 70 locks, 80 locks, and 90 barrels. At the end of the month, the salesperson sent a telegram showing -1 lock sold. The Smith then knew the sales for the month were complete and computed the salesperson's commission as follows:10%`on sales up to $1000, 15% on the next $800, and 20% on any sales in excess of $1800. Write a C program for above context and generate Test cases for same using data flow testing.
3. Take any ATM system (e.g. SBI Bank ATM system) and study its system specifications and report the various bugs.
    - Machine is accepting ATM card.
    - Machine is rejecting expired card.

- Successful entry of PIN number.
- Unsuccessful operation due to enter wrong PIN number 3times.
- Successful selection of language.
- Successful selection of account type.
- Unsuccessful operation due to invalid account type.
- Successful selection of amount to be withdrawn.
- Successful withdrawal.
- Expected message due to amount is greater than day limit.
- Unsuccessful withdraw operation due to lack of money in ATM.
- Expected message due to amount to withdraw is greater than possible balance.
- Unsuccessful withdraw operation due to click cancel after insert card.

4. Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Design and develop a program in a language of your choice to solve this triangle problem defined as follows: Derive test cases for your program based on decision- table approach, execute the test cases and discuss the results.
5. Pickup the nearest phonebook and open it to the first page of names. We're looking to find the first "Smith". Look at the first name. Is it "Smith"? Probably not (it's probably a name that begins with 'A'). Now look at the next name. Is it "Smith"? Probably not. Keep looking at the next name until you find "Smith". You started at the beginning of a sequence and went through each item one by one, in the order they existed in the list, until you found the item you were looking for. Design and develop the code for above context in C language. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
6. Suppose you have a list of 10 things and you have two friends and you ask both the friends to order the things in descending order of their liking. You will have two arrays after that, now you count the number of inversion they have and more the number of inversion, the more dissimilar their choices are, less the number of inversions the more similar their choices are. So when you sort an array using merge sort, what you do is you put the array you want to obtain on the top and the array you are starting off with at the bottom and connect all the numbers respectively. The number of intersections you obtain, will be your number of inversions. The maximum number of inversions you can have in an array is n (n-1)/2, where (n) is the size of the array and that is when your array is in the reverse order of the order in which you want to arrange it.
7. Assume that the marks obtained by a student in a test of 100 marks and compute hisgrade according to the following criteria.
   Marks>=80 grade=A
   Marks>=70 &<80
   grade=B Marks>=60
   &<70grade=C
   Marks>=50 &<60
   grade=D otherwise
   grade=F
   Design a code in C language for the above context. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
8. In the game of "twenty questions", your task is to guess the value of a hidden number that is one of the N integers between 0 and N-1. (For simplicity, we will assume that N is a power of two.) Each time that you make a guess, you are told whether your guess is too high or too low. An effective strategy is to maintain an interval that contains the hidden number, guess the number in the middle of the interval, and then use the answer to halve the interval size. Develop a C Code which suits the above context. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
9. Given a Binary Number as string, print its 1's and 2's complements.1's complement of a binary numberis another binary number obtained by toggling all bits in it, i.e., transforming the 0 bit to 1 and the 1 bit to 0. Design a C program to Implement above context and test the same using Decision table approach. Derive different test cases, execute these test cases and discuss the test results.
10. The birth-date for set of people is given in a database, which includes all different categories of birthday holders (leap year, born in different month). Design, develop, code in C language. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the testresults.

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6200	Virtualization and Cloud Computing	16	HC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce cloud computing and provide knowledge in different layers of cloud computing such as: Infrastructure as a Service(IaaS),PlatformasaService(PaaS),andSoftwareasaService(SaaS).
2. Describe various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology.
3. Explain Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization.
4. Provide knowledge about cloud security and threats.
5. Gain expertise in cloud security mechanisms.

COURSE OUTCOMES:

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

1. Explain the cloud computing concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
2. Make use of various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology.
3. Explain the cloud environment Hypervisor, Resource cluster, Multi-device Broker emulation, and explain, analyze , and evaluate various cloud computing solutions.
4. Apply Virtualization technologies: VM, Platform virtualization, storage virtualization.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

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

Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

Unit – II:

Cloud Computing Technologies: Broadband networks and internet architecture, data center technology, virtualization technology, web technology, multitenant technology, service technology **Cloud Infrastructure Mechanisms:** Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-made environment.

Unit – III:

Specialized Cloud Environment: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-per-use monitor, Audit Monitor, Failover System, Hypervisor, Resource cluster, Multi-device Broker, State Management.

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

Unit – IV:

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

RECOMMENDED LEARNING RESOURCES:

1. Thomas Erl , Ricardo Puttini , Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI,2013.

2. Kai Hwang,Geoffrey C.Fox,Jack J Dongarra,Distributed and Cloud Computing,MK,2012.

REFERENCES:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice,MK
2. Michael Miller,Cloud Computing:Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August2008.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms,Wiley.
4. AnthonyT.Velte,TobyJ.Velte,Robert Elsenpeter,Cloud Computing,Apractical approach,TATA McGRAWHILL.
5. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications,CAMBRIDGE.
6. David Marshall, Wade A. Reynolds and Dave McCrory, Advanced Server Virtualization-VMware and Microsoft Platforms in the Virtual Data Center, AUERBACH Publications.
7. Journal of Cloud Computing -Advances, Systems and Applications, SpringerOpen.
8. International Journal of Cloud Computing, INDERSCIENCEPublishers.
9. IEEE CloudComputing
10. International Journal of Cloud Applications and Computing (IJCAC), IGIGlobal.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6300	Cryptography and Network Security	16	HC	3	0	0	3	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the concepts of computer network security covering security architecture and services.
2. Describe security encryption algorithms and standards such as DES.
3. Provide the knowledge about Public key Cryptographic Principles and algorithms.
4. Explain the features of network security applications.
5. Gain expertise in electronic mail security systems.

COURSE OUTCOMES:

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

1. Identify the fundamental concepts of cryptography.
2. Apply the key distribution technique using Symmetric or Asymmetric encryption.
3. Make use of public key cryptography and message authentication.
4. Apply the System security concepts for real time secure applications.

CO PO & PSO MAPPING:

POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	3	3	2	-	3	3	2	3
CO2	3	3	3	3	2	-	-	3	3	2	-	3	3	2	3
CO3	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3
CO4	3	3	3	3	2	-	-	3	3	2	-	3	3	2	3

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

COURSE CONTENTS:

UNIT – I:

Introduction: The OSI Security Architecture, Security Attacks, Security Services, mechanisms, A model for network security, standards, symmetric encryption principles, Symmetric Block Encryption Algorithms, DataEncryptionStandards, StrengthofDES,TripleDES, AdvancedEncryptionStandard.

UNIT – II:

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

UNIT – III:

Network Security Applications:X.509 Certificate Format, Overview of Kerberos (Key Exchange), PGP- Features of PGP, Key Rings in PGP, S/MIME, IPSec Overview, Intrusion Detection.

UNIT – IV:

Electronic Mail Security: Password Management, Virus and threats, Virus Countermeasures, Firewalls, The

Need for Firewalls, Firewall Characteristics, Types of Firewalls.

RECOMMENDED LEARNING RESOURCES:

1. William Stallings, Network Security Essentials Applications and Standards, Fifth edition, Prentice Hall, 2011
2. Behrouz A. Forouzan, Cryptography and Network Security, Mc GrawHill,2007.

REFERENCES:

1. William Stallings, Cryptography and Network Security Principles and Practise, Pearson, Sixth edition, 2013
2. Joseph Migga Kizza, Guide to Computer Security, Springer Science & Media Inc., Third edition,2015
3. Andrew S.Tanenbaum, Computer Networks, Pearson, Fifthedition.
4. Atul Kahate, Cryptography and Network Security, Mc Graw Hill,2013.
5. Springer Journal of Cryptographic Engineering , ISSN2190-8508
6. ACM,ACM- International Journal of Applied Cryptography,ISSN:1753-0563
7. IEEE, IEEE Transactions on Information Forensics and Security.
8. Elsevier, Journal of Information Security and Applications.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6410	Data Mining Techniques	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures.
2. Explain association rules and algorithms.
3. Describe the classification algorithms for data categorization.
4. Illustrate the clustering algorithms for grouping datasets.
5. Demonstrate the appropriate data mining techniques for decision making.

COURSE OUTCOMES:

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

1. Explain basics of data mining, data types, similarity and dissimilarity measures.
2. Explain association rules and algorithms.
3. Describe the classification algorithms for data categorization.
4. Illustrate the clustering algorithms for grouping datasets.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction: What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization.

Unit – II:

Association Analysis: Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP GROWTH Algorithm, Evaluation of Association Patterns .

Unit – III:

Classification: Basics, General approach to solve classification problem, Decision Trees, Evaluating the performance of a Classifier, Rule Based Classifiers, Nearest Neighbour Classifiers, Naïve Bayes Classifier

Unit – IV:

Clustering: overview, K-means**,** agglomerative hierarchical clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters and Clustering Algorithms, Prototype Based Clustering.

RECOMMENDED LEARNING RESOURCES:

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education,2007.
2. Jiawei Han and Micheline Kamber,"Data Mining Concepts and Techniques"Second Edition,Elsevier, Reprinted2008.

REFERENCES:

1. K.P.Soman,ShyamDiwakarandV.Ajay,"Insight into Datamining Theory and Practice",Easter Economy Edition, Prentice Hall of India,2006.
2. G.K.Gupta,"Introduction to Data Mining with Case Studies",Easter Economy Edition,Prentice Hall of India,2006.
3. Data Mining and Knowledge Science –Springer.
4. Inderscience, The International Journal of DataMining, Modelling and Management.
5. IEEE, IEEE Transactions on Knowledge and Data Engineering.

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6420	Embedded Systems and Internet of Things	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide knowledge about the basics of embedded systems and embedded system design.
2. Describe Internet-of-Things and design principles.
3. Explain the ease of prototyping and production, and think of deployment for the community.
4. Gain expertise in integrating sensing, actuation and software.
5. Give knowledge about internet principles and techniques for writing embedded code.

COURSE OUTCOMES:

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

1. Explain the basics of embedded systems and design embedded systems.
2. Design and Develop Internet-of-Things based applications.
3. Develop prototypes of Internet-of-Things based applications, and deploy for the usage of the Community.
4. Write embedded code for constrained sensor devices.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:

Introduction to Embedded Systems: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design, Design Example: Model Train Controller, RTOS vs OS.

Unit – II:

The Internet of Things: An Overview & Design Principles: The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices, Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for Connected Devices, Affordances.

Unit – III:

Thinking About Prototyping and Prototyping Embedded Devices: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community, Electronics, Arduino, Raspberry Pi, Beagle Bone Black, Electric Imp, And other Notable Platforms.

Unit – IV:

Internet Principles and Techniques for Writing Embedded Code: Internet Communications, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols, Memory Management, Performance and Battery Life, Libraries, Debugging, Current challenges in IoT.

RECOMMENDED LEARNING RESOURCES:

1. Wayne Wolf; Computers as Components: Principles of Embedded Computing System Design; second Edition; Elsevier;2008.
2. Adrian McEwen, Hakim Cassimally; Designing the Internet of Things; Wiley;2014.
3. *Kurose, James F.; Ross, Keith W:* Computer networking: a top-down approach 5th ed., international ed.: Boston, Mass.: Pearson, cop.2010.

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi: The Internet of Things: Key Applications and Protocols; Wiley;2015.
2. Frank Vahid, Tony Givargis: Embedded System Design: A Unified Hardware/Software Introduction; Wiley;2006.
3. Springer, Design Automation for Embedded Systems
4. IEEE, IEEE Internet of Things Journal
5. Elsevier, Journal of Network and Computer Applications,
6. Elsevier, Computer Law & Security Review
7. ACM, ACM Transactions on Internet Technology(TOIT)

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6430	Digital Image Processing	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the fundamental steps of digital image processing
2. Explain the filtering techniques for processing digital images in spatial domain.
3. Illustrate transformations and filtering techniques in frequency domain for degradation/enhancement of images
4. Explore Color image processing, Compression and segmentation-models.
5. Describe edge detection and morphological operations.

COURSE OUTCOMES:

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

1. Implement the fundamental steps of Image Processing and describe various image preprocessing techniques.
2. Apply different filtering operations in spatial domain for smoothening and sharpening the images.
3. Demonstrate the use of techniques image transformation, image compression and color image processing for image processing applications.
4. Gain expertise in segmentation, object detection and recognition applications.

CO PO & PSO MAPPING:

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

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

COURSE CONTENT:

Unit – I:

Introduction to Digital Image Processing: Application fields using digital image processing, fundamental steps in digital image processing, components of an image processing system, elements of visual perception, basic concepts in sampling and quantization, intensity transformations and spatial Filtering, background, some basic intensity transformation functions, histogram processing; fundamentals of spatial filtering, smoothing spatial filters; sharpening spatial filters

Unit – II:

Filtering in the Frequency Domain: Preliminary concepts, sampling and the Fourier transform of sampled functions, DFT of one variable, extension to functions two variables, properties of the 2-D DFT, basics of filtering, smoothing frequency domain filters, sharpening frequency domain filters, image Restoration and Reconstruction, a model of the image degradation/restoration process, noise Models, restoration in the presence of noise only-spatial filtering, periodic noise reduction by 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

Unit – III:

Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full-color image processing, color transformations, smoothing and sharpening, image segmentation based on color, noise in color images, color image compression, image compression Fundamentals, some basic compression methods, elements of information theory, error-free compression, lossy compression, image compression standards

Unit – IV:

Morphological Image Processing: Preliminaries, erosion and dilation, opening and closing, the hit-or- miss transformation, some basic morphological algorithms, image segmentation, detection of isolated points, basic edge detection, edge linking and boundary detection, thresholding, region-based segmentation, segmentation using morphological watersheds, the use of motion in segmentation

RECOMMENDED LEARNING RESOURCES:

1. Gonzalez and Woods; Digital Image Processing (3rd ed.);Pearson Education;2009.
2. Alasdair Mc Andrew; Introduction to Digital Image Processing; Cengage learning;2009.
3. K. Jain; Fundamental of Digital Image Processing;PHI.
4. J. G. Proakis; Introduction to Digital Signal Processing; PHI.

REFERENCES:

1. IEEE, IEEE transactions on image processing.
2. ACM, ACM Transactions on image processing.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6440	Distributed Computing System	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce distributed systems and their architectures.
2. Describe the communication aspects in the distributed systems.
3. Explain synchronization methods, consistency models and replication management.
4. Gain expertise in fault tolerance and security aspects in the distributed systems
5. Explain the Distributed-Object based Systems, Distributed File Systems and Distributed Web-based Systems.

COURSE OUTCOMES:

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

1. Explain distributed systems and their architectures.
2. Employ synchronization methods, consistency models and replication management.
3. Implement fault tolerance and security aspects in the distributed systems.
4. Design and develop the Distributed-Object based Systems, Distributed File Systems and Distributed Web-based Systems.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit – I:
Introduction: Introduction to distributed systems, goals, types of distributed systems. **Architecture:** Architectural styles, system architectures, architectures versus middleware, self-management in distributed systems. **Processes:** Threads; virtualization; clients; servers; code migration.

Unit – II:
Communication: Remote procedure calls, message-oriented communication, stream-oriented communication, multicast communication. **Naming:** Names, identifiers and addresses; flat naming, structured naming; attribute-based naming.

Unit – III:
Synchronization: Clock synchronization, logical clocks, mutual exclusion, global positioning of nodes, election algorithms. **Consistency and Replication:** Introduction, data-centric consistency models, client- centric consistency models, replica management, consistency protocols

Unit – IV:

Fault Tolerance: Introduction; process resilience, reliable client-server communication, reliable-group communication, distributed commit, recovery. **Security:** Introduction, secure channels, access control, security management, Introduction to Distributed File System

RECOMMENDED LEARNING RESOURCES:

1. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems*: Principles and Paradigms* (2nd ed.), Pearson,2007.
2. Pradeep K. and Sinha, Distributed Operating System*: Concepts and Design* (2nd ed.), PHI,2009.

REFERENCES:

1. Andrew S. Tanenbaum, Distributed Operating System, Pearson,2008.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems: Concepts and design, (4 th ed.)Pearson,2011.
3. Springer, Springer journal on Distributed Computing.
4. Elsevier, Elsevier Journal of Parallel and Distributed Computing.
5. IEEE, IEEE Transactions on Parallel and Distributed System.
6. ACM, ACM Transactions on Computer System.
7. NPTEL Lectureshttp://nptel.ac.in/courses/106106107/.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6450	Unix System Programming	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce UNIX files and file API's.
2. Explain unix processes creation and control commands.
3. Describe signals and creation of deamon processes.
4. Explain the process relationship and Inter process communication methods.
5. Empower with client server properties and connection functions.

COURSE OUTCOMES:

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

1. Outline the history of UNIX Operating System, environment and make use of UNIX file types, file structure and file system implementation.
2. Develop the programs to implement the different process states, attributes and control the process in foreground and background.
3. Employ signals and daemons in real time applications.
4. Summarize the issues of Inter-process Communication.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

UNIX Files & API's: UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment. UNIX File Types: File System, File attributes, Application Program Interface to Files, Unix Kernel support for files, Directory files, Hard & symbolic links.

UNIT –II:

UNIX Process and Relationships: Introduction, main function, Process Termination, Command-line arguments, Environment list, Memory layout of C program, set jmp & long jmp functions, Unix kernel support for processes; **Process control**: fork, vfork, exit, wait, waitpid,waitid functions, Race conditions, exec functions, Changing User IDs and Group IDs, system Function, Process Accounting, User Identification, Process Times; **Process Relationships:** Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp functions, Job Control, Execution of shell programs.

UNIT – III:

Signals & Daemon Processes:

Signals: The UNIX Kernel Support for Signals, Signal Mask, sigaction(), The SIGCHLD Signal and the waitpid, The sigsetjmp and siglongjmp functions, Kill, Alarm, Interval Timers;

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

UNIT – IV:

Inter Process Communication: Overview of IPC Methods: Shared Memory; Pipes, popen(), pclose(), Co processes, FIFOs, System V IPC, Stream Pipes, Passing File Descriptors , Message Passing.Client-Server Properties: an Open Server-Version 1 and Client-Server Connection Functions.

RECOMMENDED LEARNING RESOURCES:

1. Terrence Chan; *UNIX System Programming Using C++,* Prentice Hall India;1999.
2. W. Richard Stevens; *Advanced Programming in the UNIX environment*, 2nd edition; Pearson Education; 2005
3. Marc J. Rochkind; *Advanced UNIX Programming*, 2nd Edition; Pearson Education;2005.

REFERENCES:

1. Maurice J. Bach; *The Design of the UNIX Operating System*, Pearson Edition,1987.
2. Kay A. Robbins; *UNIX Systems Programming,* Prentice Hall Professional,2003.
3. MachteltGarrels; Introduction to Linux, 1.27Edition
4. UreshVahalia; *UNIX Internals: The new frontiers,* Pearson education,2001.
5. Michael Kerrisk; *The Linux Programming Interface,* Pearson Education,2000.
6. *The* UNIX *System*: Program Design in the *UNIX* Environment AT&T Bell Laboratories Technical Journal Volume 63, Issue 8, October 1984, Pages: 1595–1605, R. Pike and B. W. Kernighan Article first published online: 29 JUL 2013, DOI:10.1002/j.1538-7305.1984.tb00055.x
7. *The* UNIX *System: UNIX* Operating System SecurityAT&T Bell Laboratories Technical Journal Volume 63, Issue 8, October 1984, Pages: 1649–1672, F. T. Grampp and R. H. Morris Article first published online: 29 JUL 2013, DOI:10.1002/j.1538-7305.1984.tb00058.x
8. UNIX Time-Sharing System: The C Programming LanguageBell System Technical Journal Volume 57, Issue 6, July-August 1978, Pages: 1991–2019, D. M. Ritchie, S. C. Johnson, M. E. Lesk and B. W. Kernighan
9. Unix as an Application Program David Golub, Randall Dean, Alessandro Forin, Richard Rashid School of Computer Science Carnegie Mellon University Pittsburgh, Pennsylvania15213

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6460	Research Methodology in Information Technology	16	SC	2	1	1	4	6

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiarize the student with the dimensions and methods of research.
2. Orient the student to make an informed choice from the large number of alternative methods and experimental designs available.
3. Enable the student to present a good research proposal.
4. Familiarize the student with the nature of research and scientific writing.
5. Empower the student with the knowledge and skills they need to undertake a research project, to present a conference paper and to write a scientific article.

COURSE OUTCOMES:

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

1. Appraise some basic concepts of research and its methodologies.
2. Identify appropriate research topics.
3. Prepare a project proposal (to undertake a project).
4. Organize and conduct research (advanced project) in a more appropriate manner.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit - I:

Research Methodology: An Introduction - meaning of research - objectives of research - motivation in research - types of research - research approaches - significance of research -research methods versus methodology - research and scientific method - importance of knowing how research is done - research processes - criteria of good research

Defining research problem: selecting the problem - necessity of defining the problem - techniques involved in defining a problem.

Unit - II:

Research design: meaning of research design - need for research design - features of good design - different research designs - basic principles of experimental design.

Originality in Research: Resources for research - research skills - time management - role of supervisor and scholar - interaction with subject experts.

Thesis Writing: The preliminary pages and the introduction - the literature review - methodology - the data analysis - the conclusions - the references (IEEE format).

Unit – III:

Review of Literature Description: Review of Literature: Significance of review of literature - source for literature: books -journals – proceedings - thesis and dissertations - unpublished items. On-line Searching: Database – SciFinder– Scopus - Science Direct - Searching research articles - Citation Index - Impact Factor - H-index etc, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Tools in Research Description: Introduction of analytical tools – Introduction to data analysis - least squares fitting of linear data and non-linear data - exponential type data - logarithmic type data - power function data and polynomials of different orders - plotting and fitting of linear, Non-linear, Gaussian, Polynomial, and Sigmoidal type data - fitting of exponential growth, exponential decay type data - plotting polar graphs - plotting histograms - Y error bars - XY error bars - data masking.

Tools used in Computer Science: MATLAB, NS2/3, C, C++, Java, Web Service, SPSS, SAS, LOTUS, Excel, Latex and Ms Word.

Unit – IV:

Quantitative Techniques: General steps required for quantitative analysis - reliability of the data - classification of errors – accuracy – precision - statistical treatment of random errors - the standard deviation of complete results - error proportion in arithmetic calculations - uncertainty and its use in representing significant digits of results - confidence limits - estimation of detection limit.

LaTeX and Beamer Description: Writing scientific report - structure and components of research report -revision and refining'-writing project proposal-paper writing for international journals, submitting to editors - conference presentation - preparation of effective slides, pictures, graphs – citation styles.

Software for detection of Plagiarism. IPR and Patent filing.

Note: Every batch of students comprising maximum of 4 members should define a research problem. Develop solution for the problem. Write a technical paper and publish it in IEEE/reputed conference/journal.

RECOMMENDED LEARNING RESOURCES:

1. C. R. Kothari, Research Methodology Methods and Techniques, 2nd. ed. New Delhi: New Age International Publishers,2009.
2. R. Panneerselvam, Research Methodology, New Delhi: PHI,2005.
3. P. Oliver, Writing Your Thesis,NewDelhi:Vistaar Publications,2004.
4. F. Mittelbach and M. Goossens,The LATEX Companion, 2nd. ed. Addison Wesley,2004.
5. J. W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 3nd. ed. Sage Publications,2008.
6. Kumar, Research Methodology: A Step by Step Guide for Beginners, 2nd. ed. Indian: PE, 2005.
7. B. C. Nakra and K. K. Chaudhry, Instrumentation, Measurement and Analysis,2nd. ed. New Delhi: TMH publishing Co. Ltd.,2005.
8. I. Gregory, Ethics in Research, Continuum,2005.
9. COLINNEVILLI,"The complete guide to referencing and avoiding plagiarism", Second Edition published by OpenUp Study Skills.
10. RUDRA PRATAP , " Getting Started with MATLAB " , published by Oxford University Press-2010
11. TEERAWAT, ISSARIYAKUL, EKRAM, HOSSAIN – 2008 , "Introduction to Network Simulator NS2".

REFERENCES:

1. https://www.stir.ac.uk/media/services/registry/quality/BookofPlagiarism.pdf
2. ceur-ws.org/Vol-706/poster22.pdf
3. https://books.google.co.in/books?isbn=1446281094
4. www.nalsarpro.org/pl/projects/modelproject2.pdf
5. www.uninova.pt/cam/teaching/SRMT/SRMTunit11.pdf
6. http://matlab_tools.myetang.com/index_e.htm

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6510	Intelligent Agents	**16**	**SC**	**3**	**1**	**0**	**4**	**5**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the basics of Artificial Intelligence (AI), AI problems and search strategies.
2. Explore knowledge representation issues and methods.
3. Describe reasoning and controlling knowledge.
4. Explain planning methods/algorithms in problem solving.
5. Demonstrate various learning methods for constructing knowledge and taking decisions.

Course Outcomes:

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

1. Explain basics of Artificial Intelligence concepts.
2. Explain basics of AI search strategies.
3. Represent knowledge using logic and apply reasoning methods.
4. Construct plans using agent technology for solving problems.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Problems and search: What is AI: AI problems, underlying assumption, AI technique, level of model, Problems, Problem spaces and search: 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, Best-first search, Problem reduction, constraint satisfaction, means-ends analysis

UNIT – II:

Knowledge Representation: Knowledge representation Issues, representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, frame problem, Using Predicate logic: Representing simple facts in logic, Representing Instance and ISA relationships, Computable functions and predicates, Resolution, Representing Knowledge using Rules: Procedural versus declarative knowledge, logic programming, forward versus backward reasoning, matching, Control knowledge

UNIT – III:

Planning: A simple planning agent, from probl, solving to planning, Planning in situation calculus, Basic representations for planning, A partial-order planning example, A partial-order planning algorithm, planning with partially Instantiated operators, Knowledge Engineering for planning, Practical planning: Practical planners, Hierarchical decomposition, Analysis of Hierarchical decomposition, More expressive

operator descriptions, resource constraints, Planning and acting: Conditional planning, A simple re- planning agent, fully Integrated planning and execution .

UNIT – IV:

Learning: Learning from observations: A general model of learning agents, Inductive learning; learning decision trees, Using information Theory, Learning general logical descriptions, computational learning theory, Reinforcement learning: Passive learning in a known environment, passive learning in Unknown environment, Active learning in an unknown environment, learning an action-value function, Generalization in reinforcement learning, Genetic algorithms and evolutionary programming.

RECOMMENDED LEARNING RESOURCES:

1. Elaine Rich,Kevin Knight : Artificial Intelligence, 3rd edition,TataMcgraw Hill,2009.
2. Artificial Intelligence: A Modern Approach, by Russell & Norvig, Third Edition, Prentice-Hall,2010.

REFERENCES:

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-AgentSystem.
5. IEEE, IEEE transaction for computational Intelligence.
6. Springer, Springer transaction for security based intelligent systems.

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6520	Multicore Architectures and Programming	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Impart the knowledge of recent trends in the field of multi-core processor architecture.
2. Learn how to utilize the increasing hardware capabilities of multiprocessor computer architecture's high-performance computing platforms for software development.
3. Explain various threading library APIs.
4. Describe OpenMP constructs for loops and data.
5. Illustrate hands-on experiences of applying parallel programming to achieve performance gains from multiprocessor and multi-core computer systems.

COURSE OUTCOMES:

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

1. Explain the parallel computing architecture with multicore.
2. Develop program using various parallel programming techniques for software design and development in the multi-core environment.
3. Identify challenges of using multi-core architectures, specifically due to architectural properties, language and operating system support for specific application development.
4. Apply parallel programming techniques and constructs using treading APIs and OpenMP to achieve performance gains from multi-core computer systems.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Multi-core Architecture: Single-core architecture, Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Symmetric and Distributed Shared Memory Architectures, Cache coherence, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms, GPU multi-core architectures, Understanding Performance, Performance Issues Amdahl's Law, Growing Returns: Gustafson's Law

UNIT – II:

Parallel program design: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment. Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives,

Semaphores, Locks, Condition Variables, Messages, Flow Control-based Concepts, Fence, Barrier

UNIT – III:

Threading APIs: Threading APIs for Microsoft Windows: Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework: Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads: Creating Threads; Managing Threads; Thread Synchronization; Signaling; Compilation and Linking, CUDA Introduction

UNIT – IV:

OpenMP: Challenges in Threading a Loop, Loop-carried Dependence; Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing sections, Performance oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging.

RECOMMENDED LEARNING RESOURCES:

1. Shameem Akhter and Jason Roberts,Multi-core Programming, Increased Performance through Software Multi-threading, Intel Press,2006.
2. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General-Purpose GPU Programming, Portable Documents" Addison-Wesley Professional,2010

REFERENCES:

1. Darryl Gove, Multicore Application Programming: For Windows, Linux, and Oracle Solaris, Addison-Wesley,2011.
2. The Multicore Association, Multicore Programming PracticesGuide.
3. David B. Kirk and Wen-mei W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, Elsevier Inc.,2010.
4. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Newnes,2013
5. IEEE ,IEEE Transactions on Parallel and Distributed Systems
6. IEEE ,IEEE Computer Architecture Letters
7. Elsevier, Journal of Parallel and Distributed Computing Springer Distributed Computing
8. ACM ,ACM Transactions on Knowledge Discovery from Data
9. ACM ,ACM Transactions on Computation Theory.
10. ACM, ACM Transactions on Parallel Computing
11. ACM, ACM Transactions on Programming Languages and Systems International Journal of High Performance Systems Architecture

LAB EXPERIMENTS:

A Sample Problem statement: The Scary Roller Coaster: Suppose an amusement park has a roller coaster with two trains that share a circular track. Naturally, the park owners do not want the trains to run into each other. They have asked you to help them synchronize the trains. Assume the circular track has T sections (T>2). Train 1 starts on track section 1, and train 2 starts on track section T/2. The trains go around the track in the same direction. The speed of each train varies as it goes around, being slower on uphill sections of track and faster on downhill sections.

Execute the following in the lab.

- Design the sequential program for the above problem statements
- Execute the sequential version and record the time taken for execution of the sequential program.
- Design a parallel version using p threads considering each train as a process without synchronization.
- Execute the parallel version and record the time taken for execution of the parallel program.
- Analyze the speedup with parallel solution and the problem faced without considering the synchronization.
- Synchronize the actions so that they do not ever occupy the same section of code at the same time. Use

semaphores for synchronization. Be sure to declare the semaphores and show their initial values

- Execute the synchronized parallel version and record the time taken for execution of the synchronized parallel program.
- Analyze for the equivalent speedup with synchronized parallel solution and check whether the problem faced in solution without synchronization is solved or not.
- Critical comment on the obtained solutions (sequential, parallel without synchronization, and with synchronization).
- Design the parallel version using OpenMp library constructs.
- Execute the parallel version and record the time taken for execution of the openmp based parallel program.
- Analyze the speedup with parallel solutions with pthread and openmp.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F6530	Soft Computing	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiarize with soft computing techniques and their applications.
2. Explain the neural network architecture with the appropriate heuristics based on human experience.
3. Gain the knowledge of fuzzy sets, fuzzy logic, fuzzy inference systems and its implications during thedesign of intelligent computing system.
4. Provide a foundation to apply neural networks, fuzzy logic and neuro-fuzzy logic for intelligent applications.

COURSE OUTCOMES:

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

1. Analyze various neural network architectures.
2. Design and develop the neural networks with supervised and unsupervised learning.
3. Define and design fuzzy models for the real-world applications.
4. Demonstrate some applications of neuro-fuzzy models by applying.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Introduction and Architecture of Neural Networks: Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various Course techniques; perception and convergence rule, Auto-associative and hetero-associative memory.

UNIT – II:

Back Propagation Networks Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation Course methods, effect of Course rule co-efficient; back propagation algorithm, factors affecting back propagation training, applications.

UNIT – III:

Introduction to Fuzzy Logic: Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion

UNIT – IV:

Fuzzy Membership and Rules: Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications and Defuzzificataions, Fuzzy Controller, Industrial applications.

RECOMMENDED LEARNING RESOURCES:

1. S. Rajsekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, 2003, Prentice Hall of India.
2. N. P. Padhy, Artificial Intelligence and Intelligent Systems, 2005, Oxford UniversityPress.
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 2010, WileyIndia.
4. SimanHaykin, Neural Networks, 2009,Prentice Hall of India.
5. Kumar Satish, Neural Networks, 2004, Tata Mc GrawHill.

REFERENCES:

1. IEEE Transactions on Neural Networks and learning systems.
2. IEEE Transactions on Evolutionary Computation.
3. IEEE Transactions on Fuzzy systems.
4. Journal of Applied Soft Computing–Elsevier.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6540	Advanced Computer Networks	**16**	**SC**	**3**	**1**	**0**	**4**	**5**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the advanced concepts required for designing the current computer networking
2. Expose students to 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. Describe the advanced networking concepts used for transferring voice data over the wireless channel

COURSE OUTCOMES:

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

1. Identify the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
2. List the principles of optical networks, wavelength-division multiplexing (WDM), and switching used in advance computer networks.
3. Identify the different models and architecture used in real world Software-Defined Networking.
4. Analyze the concepts of existing protocols and make use of the topological and routing strategies for an IP based networking infrastructure.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

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 – II:

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 – III:

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 – IV:

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, ClusteringProtocol-LEACH, Routing Protocols, Other Related Technologies

RECOMMENDED LEARNING RESOURCES:

1. Nader F. Mir, *Computer and Communication Networks*, Prentice Hall,2015.
2. Jean Walrand and Pravin Varniya, High Performance Communication Networks second Edition, Morgan KaufmannPublishers,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.

REFERENCES:

1. IEEE,IEEE/ACM Transactions on Networking.
2. Elsevier, Journal of Network and Computer Applications.
3. Springer, Journal of Internet Services and Applications.
4. Elsevier, Journal of Computer Communications.
5. ACM, Computer Communications Review.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6550	Programming with Java	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe Java language syntax and semantics required for understanding Java programs (applets and applications)
2. Illustrate the usage of a Java-enabled browser and/or the applet viewer to execute Java applets along with Java Application Programming Interface and Java multi-class programs.
3. Design, implement, test, and debug Java applications written using basic concepts such as primitive data types, various operators, control structures, single-subscripted arrays, and Java classes.
4. Explain the Java applications written using applets and object-based programming techniques including classes, objects and inheritance.

COURSE OUTCOMES:

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

1. Describe the primitive data types, variables, constants, various operators and develop a simple Java program using class concepts.
2. Describe the various control structures and the concepts of constructors.
3. Apply the features of OOPS and make use of array concepts in java to solve the real-world problems.
4. Explain the concept of Exception Handling in java and use a Java-enabled browser and/or the applet viewer to execute Java applets.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

UNIT – I:

Primitive Data Types and Arithmetic: Data, Data Storage, Identifiers, Syntax, Variables and Constants, the Format of a Simple Program, Arithmetic, Operator Precedence, Casting,

Objects: Introduction to Objects, The String Class, The Anatomy of a Simple Program Revisited, The AVI Package, The Window Class, Input to a Dialog Box, Converting Strings to Numbers, Command Line Arguments, Errors

UNIT – II:

Object-Oriented Programming: Abstract Data Type, Constructors, Instance Methods, Class Methods, Scope and Lifetime of Identifiers, Software Development, Object-Oriented Program Design, the AVI Package Revisited

Selection: More AVI Classes, If else Statement, Nested If Statement, Conditional Expressions, Else if

Statements, Boolean Data Type, Switch, Wrapper Classes, Yet another AVI Class!, The This Object.

UNIT – III:

Repetition and One-Dimensional Arrays: Loop Structure, While Loop, Do while Loop, Increment/Decrement Operators, For Loop, Which Loop?, Arrays Revisited, Declaring and Initializing One-Dimensional Arrays, Using Arrays, Our Last AVI Class: Check Boxes, Formatting Numbers for Output.

Advanced Concept switch Classes: Inheritance, An Example of Inheritance, Overriding Superclass Methods, Polymorphism, Instanceof Operator, Shadowed Variables, Inner Classes, Abstract Methods and Classes, Interfaces, Constructors Revisited, Instance Methods Revisited, Object Properties, Comparing Objects, Copying Objects, Passing Objects as Parameters, Garbage Collection and Object Finalization

UNIT – IV:

Exceptions and Streams: Introduction, Exception Classes, Catching an Exception, Catching Multiple Exceptions, Creating Your Own Exception Class, Throwing an Exception, Finally Blocks, Using Exception Handling, Stream Input and Output, The Stream Tokenizer Class, Text File Processing, The File Dialog.

Applets and Threads: Introduction, Applets, Input to Applets, Playing Sounds, Displaying Images, Loading Images, Arrays Revisited, Image Maps, Threads, Animation, Restrictions, Sound and Images with Applications

RECOMMENDED LEARNING RESOURCES:

1. Barry J. Holmes and Daniel T. Joyce, Object-Oriented Programming With Java; Second Edition;Jones And BartlettPublishers,2000
2. Dale Skrien;Object-Oriented Design Using Java; McGraw-Hill Higher Education;2009
3. DannyPoo;Object-OrientedProgrammingandJava;SecondEdition;Springer;2008.

REFERENCES:

1. Cay Horstmann; Big Java; 2nd Edition ; John Wiley andSons
2. Herbert Schildt; The Complete Reference Java J2SE; 5th Edition; TMH Publishing Company Ltd, New Delhi

3.H.M.Dietel and P.J.Dietel; Java How to Program; Sixth Edition; Pearson Education/PHI 4.Cay.S.Horstmann

and Gary Cornell; Core Java 2, Vol 1, Fundamentals; Seventh Edition; Pearson Education/PHI

4. Cay.S.Horstmann and Gary Cornell; Core Java 2, Vol 2, Advanced Features; Seventh Edition; Pearson Education/PHI
5. Beginning in Java 2 by Iver Horton, Wrox Publications.

LAB EXPERIMENTS:

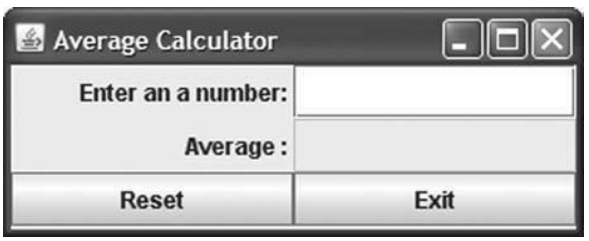
1. Write a program to estimate the cost of an upcoming vacation. There are four types of expenses: Gas; food; boarding; and entertainments. Gas expense is computed on the basis of cost per mile and estimated miles of travel. Food; boarding; and entertainments are based on cost per day and estimated days for each one of them.
2. Write a class Personal Details to input your name; height (in inches); and weight (in pounds); convert the height to centimeters and weight to kilograms and display the following results. Note: 1 inch = 2.54 centimeters and 1 pound = 0.4546 kilograms. Test the class.

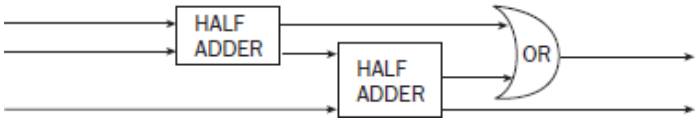
   Personal Details:
   Name Lilly
   Lady Height
   180 cm
   Weight 75 kg
3. A person is paid a gross weekly wage based upon the number of hours worked per week and the hourly rate of pay. Calculate the net pay for an employee after the following deductions:
   Federal income tax 15% of gross pay
   Social security tax 6.2% of gross pay
   Payroll savings 3% of gross pay
   Retirement pension 8.5% of gross pay

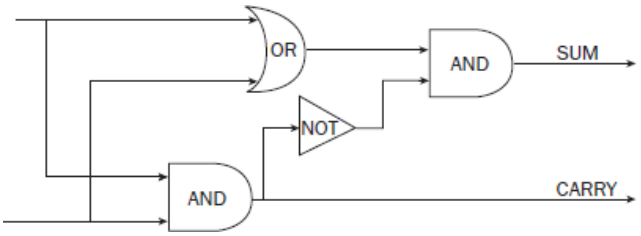
Health insurance $5.75 per employee

Write a class Deductions to input the hourly rate of pay and the number of hours worked in a week; calculate the deductions and supply enough information to display the pay check. Test the class.

4. Create a Circle class and test it. The class Circle has exactly one data member radius. Your class must provide get Radius; set Radius; and to String methods. There are two application specific methods: get Area and get Circumference. Use Math.PI; a constant defined in Math class in your code for the value ofpi.
5. Create an Employee class and test it. The instance variables are first name; last name; and annual salary. There are two application specific methods. The first method returns the monthly salary. The second method returns bonus calculated as a percentage of the annual salary plus 1000. The percentage is an explicit parameter of this method.
6. Create a class Triangle. A Triangle object keeps the x–y coordinates of three points in Cartesian plane. Provide three methods; isTriangle; isIsosceles; and isEquilateral. (Hint: Three points form a triangle; if sum of the lengths of any two sides is greater than the third side. A triangle is isosceles if at least two of its sides are equal. A triangle is equilateral if all three of its sides are equal.) To make it more challenging; create a class point and use it in your program.
7. Design and implement an object-oriented Java program that can convert a string to corresponding telephone number. If it is an uppercase letter or a lower case letter; the program will substitute it with the corresponding digit.If it is already a digit;no substitution is done. Thus;“GOODCAR”; “gooDCar”;and“go6DC2r”will be translated to 4663227.
8. Create a class Rectangle having two attributes: length and width. Keep length as private and width as protected instance variables of type int. The Rectangle class has two services: area and perimeter. Extend the class to Three DRectangle by adding a protected int attribute height. The Three DRectangle overrides the method area of the Rectangle class. Further; it has a method volume.
9. Extend the Employee class of Programming Exercise 5 to Boss class by introducing one more attribute no of Employees to keep track of the number of employees to supervise. Add a copy constructor; copy method; equals method; and compareTo method to Boss class.
10. Create an abstract class Geometric Figure with one attribute dimension and two abstract methods area and magnify. Create each of the following classes. The area of the ellipse can be calculated as Math.PI * a * b; where a and b are major and minor axes of the ellipse; respectively.
    - Create Point as a subclass of GeometricFigure. Point has two attributes x and y; both of type int.
    - Create Ellipse as a subclass of GeometricFigure. Ellipse has two attributes a and b; both of type int for major and minor axes.
    - Create Circle as a subclass of Ellipse. No additional attribute required.
    - Create Rectangle as a subclass of GeometricFigure. Rectangle has two attributes a and b; both of type int for length and width.
    - Create Square as a subclass of Rectangle. No additional attribute required.
11. Redo Programming Exercise 10; by creating an interface GeometricFigure with two methods; area and magnify.
12. Create a user interface similar to the one shown in Figure below. The user can enter any number and press the Enter key to see the running average. The user can reset the running average to zero using the reset button.







13. (a) Figure below illustrates the logic circuitry of a half adder. Implement a HalfAdder class that comprises objects from AND gate; OR gate; and NOT gate classes. Test the HalfAdd erclass. (b)Figurebelowillustratesthelogiccircuitryofafulladdercomposedoftwohalfaddersand an OR gate. Using the classes you implemented in part (a); write a FullAdderclass. (b)Devise a graphical interface to input two four-bit numbers and; using the FullAdder class developed in part (b); show the result of adding the numbers.

14. Implement a class Queue; based upon a linked list; which allows objects to join at the rear of the list and leave from the front of the list. In addition to the constructor; you should devise methods to test whether the queue is empty; to insert and delete objects from the queue; and to display the values of the objects in the list.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6600	Computer Networks Simulation and Programming Lab	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explore the networks architecture and quantitative performance metrics that drive network design.
2. Examine the various concepts of Internet and principles of the TCP/IP protocol suite.
3. Compare different congestion control algorithms and concepts of resource allocation in network.

COURSE OUTCOMES:

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

1. Apply the concept to design networks for small and medium enterprises.
2. Differentiate various types of network configurations and apply them to meet the changing and challenging networking needs of organizations.
3. Configure, verify, and analyse the performance of communication networks at an introductory level.
4. Demonstrate the traffic monitoring using the simulation tool.

CO PO & PSO MAPPING:

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	-	-	-	3	-	3	-	-
CO3	3	3	-	-	3	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-	-

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

LAB EXPERIMENTS:

PART A – Simulation exercises using NS2 simulator

Instructions to students:

The values given in the simulation exercises are indicative. However, the students are suggested to give different set of inputs and analyze the output.

1. A network consists of three nodes (n0-n2). Link existence (duplex in nature) between the nodes is as follows: n0-n1 and n1-n2. The link no-n1 has 10 Kbps of bandwidth and 100 ms of delay. Thelinkn1-n 2 has 5Mbps of bandwidth and 200ms of delay. Node “n0” is having some data to send to node “n2” through node “n1”, which is a hub device. Each node uses Drop Tail queue of which the maximum size is 10.Write a Tcl script to observe the packet flow for the given network in network animator(NAM).

2. A network consists of 4 nodes (n0-n3) . Here, n0 and n1 are source nodes, n2 is a router and n3 is the destination node. The duplex links between the nodes is as follows:
   - n0 and n2 has 10 Mbps of bandwidth and 10 ms of delay,
   - n1 and n2 has 10 Kbps of bandwidth and 100 ms of delay, and
   - n2 and n3 has 10 Kbps of bandwidth and 100 ms of delay.

   A TCP agent is attached to n0 and connection is established to a TCP sink agent attached to n3.

   An UDP agent that is attached to n1 is connected to a NULL agent attached to n3. An FTP and a CBR traffic generator are attached to a TCP and UDP agent, respectively. The TCP agent

between n0-n3 has a packet size of 200 bytes with a time interval of 0.01 seconds, and the UDP agentbetween n1-n3 has a packet size of 300 bytes with the time interval of 0.001 seconds.
The CBR is set to start at 0.1 seconds, FTP is set to start at 0.3 seconds and both stop at 5 seconds. Write a Tcl script to observe the packet flow for the given network and observe the output in NAM for this network scenario.

3. A network consists of 4 nodes (n0-n3) . Here, n0 is the FTP source, and n1 is the TELNET source, n2 is a router and n3 is the common destination node. The duplex links between the nodes is as follows:
   - n0 and n2 has 5 Mbps of bandwidth and 10 ms of delay,
   - n1 and n2 has 10 Mbps of bandwidth and 10 ms of delay, and
   - n2 and n3 has 15 Mbps of bandwidth and 10 ms of delay.

   A TCP agents are attached to n0 and n1 and connection is established to a sink agent attached to n3. With Telnet connection, packet size is set to 500 Megabytes with a time interval of 0.001 seconds. The default maximum size of a packet that a TCP agent can generate is 1 kb.
   Both FTP and TELNET are set to start at 0.3 seconds, and stop at 5 seconds. Write a Tcl script to observe the packet flow for the give n network and observe the output in NAM for this network scenario.

4. A network consists of 6 nodes (n0-n5). The duplex links between n0 and n2, n1 and n2,n2 and n3, n3 and n4 & n4 and n5 with 0.1 Mbps of bandwidth and 10 ms of delay. Create two PING agents and attach them to the nodes n0 and n2. Connect the two agents and schedule the transmission of PING messages at an interval of 0.2 seconds and finish at 1.0 second. Write a Tcl script to observe the packet flow for the given network and observe the output in NAM for this network scenario.

5. A network consists of n nodes (say n =6). The duplex links between the nodes is as follows:
   - n0 and n2 has 2Mbps of bandwidth and 10 ms of delay,
   - n1 and n2 has 2Mbps of bandwidth and 10 ms of delay,

   The Simplex links between the nodes is as follows:
   - n2 and n3 has 0.3Mbps of bandwidth and 100 ms of delay.
   - n3 and n2 has 0.3Mbps of bandwidth and 100 ms of delay.

   The LAN is established between the nodes n3, n4 and n5 with 0.5 Mbps of band width and 40ms delay. Each node uses DropTail queue of which the maximum size is 10. Write a Tcl script to observe the packet flow for the given network and observe the output in NAM for this network scenario.

6. For a wireless network consisting of three mobile nodes (n0-n2), Nodes are configured with the specific parameters of a wireless node. Initial location of the node is fixed. Nodes are given mobility with fixed speed and fixed destination location. TCP agent is attached to node0 and TCP sink agent is attached to node1. Both the agents are connected and FTP application is attached to TCP agent. Write a Tcl script and make an ad-hoc simulation to analyze the output in the trace file. Use the routing protocol as Adhoc on demand distance vector(AODV).

PART B

Instructions to students: *The following experiments shall be implemented in C/ C++.The values given in the following exercises are indicative. However, the students are suggested to give different set of inputs and analyze the output.*

1. Assume a message represented by the polynomial $M(x) = x^n + . x^2 + x + 1$, choosing 'n'in the range of 4 to 16. Message is sent from the sender with a checksum. When it arrives at the receiver's end, check sum is recalculated for detecting the error. Hence, write a programfor error detecting code using CRC-CCITT (16-bits), considering 10001000000100001 as the standard divisor polynomial.

2. A network topology consists of n nodes (varying from 4-10). Links connecting the nodes have some costs/weights associated with them. Links for unreachable nodes are indicated by infinity(say,999).The sample cost adjacency matrix is given below for a network of 4 nodes:

0	2	99	99
2	0	1	99
99	1	0	4

99 99 4 0

Write a program for distance vector algorithm to find suitable path for transmission by using the routing table for each node.

3. Using TCP/IP sockets, write a client-server program to make client send the file name and the server to send back the contents of the requested file file name "sample.txt" with the following contents:"HIIAMATREVAUNIVERSITY.SEEYOUSOON". Steps forest ablishinga TCP socket on the client side are the following:

   - Create a socket using the socket()function;
   - Connect the socket to the address of the server using the connect()function;
   - Send and receive data by means of the read() and write()functions.

   The steps involved in establishing a TCP socket on the ***server side*** are as follows:

   - Create a socket with the socket()function;
   - Bind the socket to an address using the bind()function;
   - Listen for connections with the listen()function;
   - Accept a connection with the accept() function system call. This call typically blocks until a client connects with the server.
   - Send and receive data by means of send() and receive().

   Display suitable error message in case the file is not present in the server.

4. There is a single Server process which runs continuously in background, even though if there is no client to interact with it. Client processes runs in foreground and interacts with the server process. Both the client and server processes run on the same machine.

5. The Client process accepts a command (a shell command) from the user and sends it to the Server via a FIFO which is a public channel between Client and Server for processing. Assume this FIFO name as **PUBLIC fifo** since its existence is known to all clients and the server. Once the command is received, the Server executes it using the **popen–pclose** sequence (which generates an unnamed pipe in the Server process). After execution Server process returns the output of the command executed to the client over a FIFO which is a private channel between the client and server. Let us name this FIFO as PRIVATE fifo. The Client, upon receipt, displays the output on the screen. Implement this scenario using message queues or FIFOs as interposes communication channels by adopting the following procedure:

   Functionality steps of a Client process:

   - Create a unique name for the PRIVATE fifo and invokeit.
   - Open the PUBLIC fifo in write mode.
   - Prompt for command from user.
   - Write command to PUBLIC fifo for Server to process.
   - Open PRIVATE fifo in read mode to read the contents from Server.

   Steps of a Server process:

   - Generate a PUBLIC fifo and open it in both read and write mode. Wait for the message from a Client process.
   - Read the message from PUBLICfifo.
   - Open the Client's PRIVATE fifo in write mode.
   - Execute the command from Client process using popen.
   - Write the output into Client's PRIVATE fifo.

   NOTE: Each and every Client process should have its own unique PRIVATE fifo to receive information from Server.

6. Choose the two prime numbers, p=17 and q=11. Write a program for public key encryption system using RSA algorithm to encrypt and decrypt the message. For a message M="he12ll34o",show the encryption and decryption.

7. Examine node transmitting/receiving packets to/from other nodes. Using a random function, vary the packet size, considering the following cases.
   Case i: Output rate of 5 Bytes and Bucket size of 10 Bytes.

   Case ii: Output rate of 10 Bytes and Bucket size of 5 Bytes.

   Write a program for congestion control implementing leaky bucket algorithm.

Recommended Learning Resources:

1. J.F.KuroseandK.W.Ross,"ComputerNetworking:ATop-DownApproachfeaturingtheInternet", Prentice Hall Publishing Company,2002.
2. Peterson L. and Davie, B. "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers,1996.

References:

1. M.A.GalloandW.M.Hancock,"Computer Communications and NetworkingTechnologies",1st Edition, Cengage Learning,2011.
2. NataliaOliferandVictorOlifer,"Computer Networks:Principles,Technologies & Protocols for Network Design",Wiley India,2011.
3. Dr.Sunilkumar S.Manvi,Mahabaleshwar S.Kakkasageri,"Wireless and Mobile Networks:Concepts and Protocols",2nd edition, Wiley-India, 2011.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F6700	**Mini Project**	16	HC	0	1	3	4	8

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 OBJECTIVES:

1. To create an Industrial environment and culture within the school 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:

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

CO PO & PSO MAPPING:

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
3. (by choosing the research papers of reputed Journals) in their area of interest.
4. The students shall choose a base paper from the list of papers they would have surveyed.
5. The students shall identify the research gaps in their selected research domain, and finalize their problem statement
6. with objectives for the research based mini project.
7. The students shall be completing the synopsis presentation (phase-1 presentation (progress)), and phase-2
8. presentation (implementation with demo) as per the calendar set by the concerned coordinator.
9. 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.

IV year Detailed Syllabus

VII Semester Syllabus

SEVENTH SEMESTER

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7100	Machine Learning and Applications	16	HC	3	0	1	4	4

COURSE OBJECTIVES:

The objectives of the course are to:

1. Study the basic theory underlying machine learning.
2. Explain machine learning algorithms to solve problems of moderate complexity for data analysis.
3. Describe the concept of Genetic Programming and Artificial Neural Network.
4. Discuss the implementation of Machine learning algorithms and modules.

COURSE OUTCOMES:

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

1. Make use of unsupervised learning techniques to identify patterns and structure within datasets
2. Identify suitable Ensemble methods to solve the given real-world problems.
3. Develop an application to make use of decision trees to solve the real-world problem
4. Apply convolutional neural networks concepts in real world application.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-1:

Introduction: Well-Posed Learning Problems, Designing a Learning System, Perspectives and Issues tin MachineLearningExamplesofMachineLearningApplications, LearningAssociations, Classification, Regression, Unsupervised Learning, and Reinforcement Learning. Supervised Learning. Concept Learning and the General-to-Specific Ordering: A Concept Learning Task, Concept Learning as Search, FIND-S.

Unit-2:

Dimensionality Reduction: Subset Selection, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Classification.

Unit-3:

Clustering: Introduction**,** k-means, nearest neighbor, expectation maximization algorithm, Supervised

learning after clustering, hierarchical clustering,choosing the number of clusters.Decision Tree Learning.

Unit-4:

Artificial Neural Networks: Introduction, Perceptrons, Multilayer Networks and the Backpropagation Algorithm. Reinforcement Learning: Introduction, Learning task ,Q-learning. Design and Analysis of Machine Learning Algorithms and experiments using WEKA//Rapid Miner Tool

RECOMMENDED LEARNING RESOURCES:

1. Tom Mitchell: Introduction to Machine Learning Chapters 1, 2, 3, 4, 6, 8, 9.1 to 9.4, 13 2. 2. EthemAl payd in: Second edition MIT press McGraw-Hill Chapters 1, 2, 6, 7,19

2. William W Hsieh Machine Learning Methods in the Environmental Sciences, Neural Networks, Cambridge University Press.

REFERENCES:

1. EthemAlpaydin: Introduction to Machine Learning, Second edition MIT press, 2010. Chapters 1, 2, 6, 7,19.
2. YoshuaBengioandAaronCourville, DeepLearning -IanGoodfellow,MITPressbook,2016
3. Richardo.Duda,PeterE.HartandDavidG.Stork,patternclassification,JohnWiley&SonsInc.,2001
4. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press,1995

The laboratory exercises will include use of various machine learning algorithm for data classification, data regression, clustering using WEKA Tools. The list of experiments are:

The Wek a tool should be taught to the students

- Introduction to WEKA, installation of WEKA Tool and demonstration.
- Perform data preprocessing.
- Perform classification to the dataset.
- Perform Clustering using k-means for the contact lens dataset.
- Perform Logic Regression for Ir is dataset.
- To Visualize the results using the Tool.
- To Analyze the results using the Tool.
- Apply ID3 decision tree algorithm to House database.
- Apply CART decision tree algorithm To IRIS database.

SOFT CORE GROUP-4:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7310	Big Data and Hadoop	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce Big Data concepts and managing bigdata.
2. Describe hadoop and processing data using hadoop.
3. Illustrate the use of map-reduce analytics using hadoop and related tools.
4. Describe Hadoop tools, PIG and Hive architecture

COURSE OUTCOMES:

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

1. Make use of the concepts of Big Data in real world applications.
2. Apply the theories of Hadoop
3. Illustrate the fundamental techniques and scalable algorithms like Hadoop, Map Reduce
4. Develop a real-world application using Hadoop tools

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction to Big Data: - Classification of digital data, characteristics of data, evolution of big data, definition of big data, challenges with big data, what is big data, why big data, traditional business intelligence (BI) versus big data, A typical data warehouse environment, A typical hadoop environment, top challenges facing big data, why is big data analytics, what kind of technologies are we looking toward to help meet the challenges posed by big data?

Unit-II:

Introduction to Hadoop:-Introducing Hadoop, why Hadoop, why not RDBMS, RDBMS versus Hadoop, History of Hadoop, Hadoop overview, usecase of Hadoop, Hadoop distributors, HDFS, Processing data with Hadoop, NoSQL, Hadoop-Features of Hadoop.

Unit-III:

MapReduce-A weather dataset, Analyzing data with UNIX tools, Analyzing data with Hadoop, scaling out, How MapReduce Works, Anatomy of a MapReduce job run, shuffle and sort, job scheduling.

Unit-IV:

Hadoop Related tools:-Introduction to PIG, What is PIG, The anatomy of PIG,PIG on Hadoop, PIG Latin, Data

types in PIG, running PIG, Execution modes, HDFS Commands, Relational operators, PIG versus Hive, Introductionto HIVE, What is hive ,hive architecture, hive data types, hive file formats, HQL,UDF.

LAB EXPERIMENTS:

Implement the following:

1. Write a MapReduce program to count the occurrences of similar words in a file.
2. HDFS start by reviewing HDFS, You will find that its composition is similar to local Linux file system. We will use the Hadoop File System command and when Interacting with HDFS.
   Review the command available for the HDFS. Copies file foo.txt from local disk to the user's directory in HDFS. Get a directory listing of the user's home directory in HDFS. Get a directory listing of HDFS root directory. Display the contents of the HDFS file.
3. HDFS start by reviewing HDFS, You will find that its composition is similar to local Linux file system. We will use the Hadoop File System command and when Interacting with HDFS.
   Move that file to local disk named as different "buzz.txt". Create a directory called input under user's home directory. Delete the directory
   Input holds all it contents.
   Verify the copy by listing the directory contents in HDFS.
   Display the contents of the HDFS file.
4. Write the HDFS command for the following instruction
   sets.Copy file from Local file to HDFS system.
   Copy file from HDFS to Local file system.
   Move from the source HDFS to the destination HDFS.
5. Write the HDFS command for the following instruction
   sets.Copy the complete directory in another directory
   Display the hdfs contents
   Display the Local linux file contents
6. Using Hive codes and creates the following:
   Create a database, then
   Create a table inside that database.

RECOMMENDED LEARNING RESOURCES:

1. Seema Acharya, Subhashini Chellappan, Big data and data Analytics, Wiley,2015.
2. O'Reilly, Hadoop The Definitive Guide, Tom White,2012

REFERENCES:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj: Big data, big analytics,Wiley,2013
2. P. Tan, M. Steinbach, V. Kumar, *Introduction to Data Mining*, Addison-Wesley,2005.
3. J. Han, M. Kamber, *Data Mining: Concepts and Techniques*, 2nd ed. Morgan Kaufmann

2005.

4. IEEE,Introduction to the IEEE Transactions on BigData
5. Elsevier,Big data research journal Elsevier
6. Springer, Journal on Big Data Springer.
7. ACM DL,The Journal of Machine Learning Research-ACM.

Course Code	Course Title	Duration	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7320	High Performance Computing	14	SC	3	0	1	5	

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the design, analysis, and implementation, of high performance computational science and engineering applications.
2. Explain advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.
3. Develop knowledge and skills concerning the key factors affecting performance of computational science and engineering (CSE)applications.
4. Mapping applications to high-performance computing systems.

COURSE OUTCOMES:

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

1. Identify different levels of parallelism that can be applied to solve the given real world problems.
2. Develop the programs using different levels of parallelism to solve the real-world problems.
3. Make use of features of OpenMP to develop parallel programs for solving real world problems.
4. Identify different modern Processors to be used in real world application.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Parallel Programming Platforms: Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process- Processor Mapping and Mapping Techniques

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.

Unit-II:

Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics

Unt-III:

Programming Using the Message Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding,

Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators.

Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX , Thread Application Programmer Interface, Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: A Standard for Directive Based Parallel Programming.

Unit-IV:

Parallel Algorithms and Applications:

Numerical Algorithms: Dense Matrix Algorithms -Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations;

Non-numerical algorithms: Sorting -Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort;

Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs.

RECOMMENDED LEARNING RESOURCES:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley,2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall,2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill,2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley,1994.
6. J. Dongarra, I. Foster, G. Fox, W. Gropp, K. Kennedy, L. Torczon, A. White, editors, The Sourcebook of Parallel Computing, Morgan Kaufmann,2002.

REFERENCES:

1. IEEE Transactions on Parallel and Distributed Systemshttp://www.computer.org/tpds/
2. IEEE Computer Architecture Lettershttp://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=10208
3. Elsevier Journal of Parallel and Distributed Computinghttp://www.journals.elsevier.com/journal-of-parallel-and-distributed-computing/
4. Springer Distributed Computinghttp://www.springer.com/computer/communication+networks/journal/446
5. ACM Transactions on Knowledge Discovery from Datahttp://tkdd.acm.org/
6. ACM Transactions on Computation Theoryhttp://toct.acm.org/
7. ACM Transactions on Parallel Computinghttp://topc.acm.org/
8. ACM Transactions on Programming Languages and Systemshttp://toplas.acm.org/
9. International Journal of High Performance Systems Architecturrhttp://www.inderscience.com/jhome.php?jcode=IJHPSA#topics2

LAB EXPERIMENTS:

1. Learn about searching good recent journal/conference papers in the high performance computing.
2. Choose one of the relevant paper for C1-seminar with the hep of subject teacher.
3. Prepare power point presentations for the chosen topic.
4. Design a program for the given problem statement.

Sample problem statement:

Pedestrian streams: Two streams of pedestrians move diagonally across an open square area, crossing at the center. Model this on a square grid using an appropriate multithreading design. Each stream is composed of t pedestrians started every n milliseconds that start in a diagonal line and move every s milliseconds toward the corresponding position at the opposite corner. Each agent should judge it's next move by a local examination of a fixed distance of adjacent grid cells, and should avoid collisions. Both streams should start at once. The whole system should not deadlock. Consider the effect of changing various parameters, such ast, n, s, as well as the size of the grid, the visibility radius of each pedestrian, their speed, etc. on general throughput/latency and on concurrent scalability.

5. Write C/C++ code for the above designed problem statement
6. Modify the problem design using principles of parallel algorithm for achieving high performance
7. Modify the written code of the problem according to the modified design using the messagepassing paradigm
8. Modify the written code of the problem according to the modified design using shared address space platform -POSIX
9. Modify the written code of the problem according to the modified design using shared address space platform -OpenMP
10. Write the C/C++ code for matrix multiplication using high performance computing techniques
11. Write the C/C++ code for quicksort using high performance computing techniques
12. Write the C/C++ code for finding shortest path using high performance computing techniques

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7330	Pattern Recognition	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce basics of Pattern Recognition, learning and adaptation techniques.
2. Illustrate supervised and unsupervised pattern classification techniques.
3. Describe pattern classification using Neural Network.
4. Provide knowledge on statistical pattern recogniton.

COURSE OUTCOMES:

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

1. Identify the areas where Machine Learning can offer a solution to Pattern Recognition.
2. Apply probability and data set to evaluate the pattern recognition features.
3. Make use of data structures representation and classifier algorithms to solve pattern recognition problems.
4. Develop algorithms for applications involving Pattern Recognition.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction to Pattern Recognition: Introduction to Pattern Recognition; Applications of pattern recognition; Design principles of pattern recognition system; Learning and adaptation; Pattern recognition approaches; statistical decision theory

Unit-II:

Classification: Introduction to Classification Techniques: Nearest Neighbor (NN) Rule; FCM RULE; K- Means Rule; Maximum-Likelihood estimation; Bayesian Parameter estimation: Gaussian Case; general theory; Dimension reduction methods - Principal Component Analysis (PCA)

Unit-III:

Unsupervised Classification: Clustering; Hierarchical Clustering; Graph Based Method; Sum of Squared Error Technique; Iterative Optimization

Neural Network Classifier: Single and Multilayer Perceptron; Back Propagation Learning; Hopfield Network; Fuzzy Neural Network

Unit-IV:

Statistical Pattern Recognition: Bayes Decision Theory; Minimum Error and Minimum Risk Classifiers; Discriminant Function and Decision Boundary; Normal Density Discriminant Function for Discrete Features; Parameter Estimation

RECOMMENDED LEARNING RESOURCES:

1. Earl Gose; Richard Johnson burg; Steven Jost; *Pattern recognition and Image Analysis*; PHI; 2nd edition latest reprint 2011.
2. Richard O Duda; Peter E Hert*; Pattern Classification*; John Wiley and sons; 2ndedition; 2009.

REFERENCES:

1. IEEE, Transactions on ImageProcessing
2. IEEE, The IEEE Transactions on Pattern Matching and Machine Intelligence
3. Elsevier, Patern Recognition, The Journal of the Pattern Recognition Society

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7340	Network Management Systems	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Outline the concepts and architecture standards for network management.
2. Describe the standards, models, symbols and terminology associated with network management.
3. Illustrate SNMP V1 based network management, list internet organizations and standards.
4. Explain remote network monitoring through RMON.
5. Discuss the applications of network management.

COURSE OUTCOMES:

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

1. Identify network management models with objects, symbols and conventions.
2. Formulate a SNMP based solution to a given unmanaged network.
3. Integrate RMON with SNMP for a distributed network.
4. Apply network management techniques to a given network.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction: Analogy of Telephone Network Management, Computer and Telecommunication network, Distributed Computing Environment, Networks Systems and Standards, Case Histories of Networking and Service Management, Challenges of Information Technology Management

Network Management: Goals, Organization and Functions, Network Management Architecture and Organization, Network Management Perspectives.

Unit-II:

Basic Foundations: Standards, Models and Language: Network Management Model, Organization Model, Information Model, Communication Model, ASN.1-Terminology, symbols and Conventions, Objects and Data Types, Object Names, Example of ASN.1 from ISO 8824, Encoding Structure, Macros, Functional Model.

Unit-III:

SNMPv1 Network Management: Managed Network: Case Histories and Examples, History of SNMP Management, Internet Organizations and standards, Internet Documents, SNMP Model, Organization Model, System Overview, and Information Model.

SNMP Management - RMON: Remote Monitoring, RMON SMI and MIB, RMON1, RMON2.

Unit-IV:

Network Management Applications: Configuration Management, Fault Management, Performance

Management, Event Correlation Techniques, Security, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

RECOMMENDED LEARNING RESOURCES:

1. Mani Subramanian: *NetworkManagement-PrinciplesandPractice*;2ndPearsonEducation;2010.
2. J. Richard Burke: *Network management Concepts and Practices: a Hands-On Approach*; PHI;2008.

REFERENCES:

1. Dinesh Chandra Verma: *Principles of Computer Systems and Network Management,* Springer,2009
2. IEEE, IEEE Transactions on Network and Service Management. ISSN:1932-4537
3. ACM,ACM Transactions on Management Information Sy stems. ISSN:2158656X,21586578

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7350	Network Programming	16	HC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of the course are to:

1. Understand the basics of computer networks and protocols.
2. Explain the various aspects of computer network programming.
3. Understand the Client/Server architecture.
4. Explore the various services of Client/Server model.
5. Describe the functionality of thread creation and termination.

COURSE OUTCOMES:

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

1. Illustrate the use of socket programming in a real-world application.

2. Develop an application using client and server Architecture for a real-world application.

3. Develop applications using techniques such as multiplexing, forking, multithreading in network communication.

4. Identify different encryption and decryption techniques to maintain security in real world network communication.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I: Introduction

Introduction: Overview of UNIX OS,Environment of a UNIX process, Process control, Process relationships Signals, Interposes Communication, overview of TCP/IP protocols

Unit-II: Elementary Tcp Sockets

Introduction to Socket Programming: Introduction to Sockets, Socket address Structures, Byte ordering functions, address conversion functions, Elementary TCP Sockets, socket, connect, bind, listen, accept, read, write , close functions, Iterative Server – Concurrent Server.

Unit-III: Application Development

TCP Echo Server: TCP Echo Client, Posix Signal handling, Server with multiple clients, boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown, I/O multiplexing,I/O Models, select function shutdown function, TCP echo Server(with multiplexing),poll function, TCP echo Client (with Multiplexing)

Unit-IV: Socket Options, Elementary Udp Sockets

Socket options: get socket and set socket functions, generic socket options, IP socket options, ICMP socket options, TCP socket options, Elementary UDP sockets, UDP echo Server, UDP echo Client, Multiplexing TCP and UDP sockets, Domain name system, get host by name function, Ipv6 support in DNS, get host by adr function, get serv by name and get serv by port functions.

RECOMMENDED LEARNING RESOURCES:

1. W. Richard Stevens, "Advanced Programming in The UNIX Environment", Addison Wesley,1999.
2. W.RichardStevens,"UNIXNetworkProgrammingVol-I",ThirdEdition,PHIPearsonEducation,2003
3. M. J. Donahoo and K. L. Calvert, TCP/IP Sockets in C: Practical Guide for Programmers (The Practical Guides Series), Morgan Kaufmann Publishers, January2000

REFERENCES:

1. Quinn,D.Shute,"Windows Sockets Network Programming",Addison-Wesley,2005,ISBN0201 63372
2. Graba,"An Introduction to Network Programming with Java",Pearson Education,Addison Wesley, 2003, ISBN 0 321 116143.
3. D. E. Comer, Computer Networks and Internets, Prentice Hall, Englewood Cliffs, NJ, USA, 2nd Edition,1999.
4. L. L. Peterson and B. S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, 2nd Edition,1999.
5. M. J. Donahoo and K. L. Calvert, TCP/IP Sockets in C: Practical Guide for Programmers (The Practical Guides Series), Morgan Kaufmann Publishers, January 2000.
6. K. L. Calvert and M. J. Donahoo, TCP/IP Sockets in Java: Practical Guide for Programmers (The Practical Guides Series), Morgan Kaufmann Publishers, October2001.
7. David Reilly and Michael Reilly, Java Network Programming and Distributed Computing, Addison- Wesley (ISBN:0-201-71037-4).
8. Advanced Programming in the UNIX Environment, 2nd ed., W. Richard Stevens, Stephen A. Raqo, Addison Wesley,2005.
9. UNIX Systems Programming, Kay Robbins and Steven Robbins, Prentice Hall,2003
10. http://www.netbook.cs.purdue.edu
11. http://www.cs.arizona.edu/llp/book/book.html
12. http://wps.aw.com/aw_kurose_network_2
13. http://www.kohala.com/start/unpv12e.html

LAB EXPERIMENTS:

1. Cyclic Redundancy Check is an error-detecting code commonly used in data communication and storage devices to detect accidental changes to raw data. In this mechanism a special number is appended to a block of data in order to detect any changes introduced during storage (or transmission). The CRC is recalculated on retrieval (or reception)and compared to the value originally transmitted, which can reveal certain types of error. Implement this CRC algorithm using C language.

2. RARP (Reverse Address Resolution Protocol) is a protocol by which a physical machine in a local area network can request to learn its IP address from a gateway server's Address Resolution Protocol (ARP) table or cache. A network administrator creates a table in a local area network's gateway router that maps the physical machine (or Media Access Control - MAC address) addresses to corresponding Internet Protocol addresses. Let us simulation this scenario in C language.

3. File Transfer Protocol (FTP) is a standard network protocol used to exchange and manipulate files over a TCP/IP based network, such as the Internet. FTP is built on a client-server architecture and utilizes separate control and data connections between the client and server applications. RS-232 is limited to point-to-point connections between PC serial ports and devices. Let us develop a software that performs this action.

4. HTTP File Server, otherwise known as HFS, is a free web server specifically designed for publishing and sharing files. Develop an application for this scenario to download a file from a HTTP server.

5. Hyper Text Transfer Protocol (HTTP) is perhaps the most significant protocol used on the Internet today. Web services, network-enabled appliances and the growth of network computing continue to expand the role of the HTTP protocol beyond user-driven web browsers, while increasing the number of applications that require HTTP support. Develop a software to create a HTTP Client to download a file from HTTP Server.

6. The File Transfer Protocol (FTP) is a standard network protocol used for the transfer of computer files from a server to a client using the Client–server model on a computer network. FTP is built on a client-server model architecture and uses separate control and data connections between the client and the server. Write a program in C, to implement a simple FTP client.

7. Unix provides various function calls to help you manipulate IP addresses. These functions convert Internet addresses between ASCII strings (what humans prefer to use) and network byte ordered binary values (values that are stored in socket address structures). Write the source code to implement this concept using C language.

8. The simplest TCP server application is an Echo Server (RFC 862). It simply listens to port 7, and when it receives a data packet, it returns the data packet back to the client. The program EchoClient establishes a connection with a server, reads lines from standard input, sends them to the server, and prints back out the server's response. Let us develop a program to implement this scenario.

9. A GUI application must respond to events from the user and from the operating system. Events from the user include all of the ways that someone can interact with your program: mouse clicks, key strokes, touch-screen gestures, and so forth. Events from the operating system include anything "outside" of the program that can affect how the program behaves. Write a program to simulate this scenario using Java.

10. An Object Output Stream writes primitive data types and graphs of Java objects to an Output Stream. The objects can be read (reconstituted) using an Object Input Stream. Persistent storage of objects can be accomplished by using a file for the stream. If the stream is a network socket stream, the objects can be reconstituted on another host or in another process. Write a program in Java to simulate this scenario.

11. Multicasting means Broadcasting to Multiple Recipients. In addition to Datagram Socket , which lets programs send packets to one another, java.net includes a class called Multicast Socket . This kind of socket is used on the client-side to listen for packets that the server broadcasts to multiple clients. Write a program for this purpose.

12. Client server chat application is based on java swing and used socket package. It is simple and easy and require only core java knowledge. The chat uses TCP/IP sockets to communicate, and can be embedded easily in a Web page. Let us develop a program to simulate this scenario using Java.

SOFT CORE GROUP-5:

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs/ Wk
BTCS15F7410	Advanced Database Management Systems	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the concepts of object orientation in databases and query language.
2. Describe parallel and distributed databases and operations.
3. Discuss online transaction processing, decision support and dataware housing.
4. Explain enhanced data models for advanced applications.
5. Demonstrate the database concepts with an application.

COURSE OUTCOMES:

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

1. Explain the concepts of object database and design the object database for a given problem.
2. Apply the knowledge to design and develop distributed database systems for various application domains.
3. Compare the performance of databases.
4. Formulate applications for distributed databases.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Object and Object-Relational Databases: Overview of Object-Oriented Concepts – Objects, Encapsulation, Type and class hierarchies, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems.

Unit-II:

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery;

Unit-III:

Decision Support: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support; View materialization; Maintaining materialized views.

Unit-IV:

Enhanced Data Models for Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

RECOMMENDED LEARNING RESOURCES:

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.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill,2010.
2. CJ Date,Database Design and Relational Theory:Normal Forms and All that Jazz,O'Reilly,April 2012.
3. IEEE, IEEE Transactions on Knowledge and Data Engineering
4. Elsevier, Elsevier Data and Knowledge Engineering
5. ACM, ACM Transactions on Database Systems

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs/ Wk
BTCS15F7420	VLSI Design & Algorithms	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objective of this course is to:

1. Introduce the working principle of MOS transistor and CMOS technology.
2. Describe the concepts of physical design and design rules of MOS.
3. Discuss Graph algorithms for physical design.
4. Outline the chip input output devices.
5. Provide introduction to toll development and insight to CAD algorithms.

COURSE OUTCOMES:

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

1. Explain the working principle of MOS transistor and MOS inverters.
2. Define all the definitions associated with MOS inverters.
3. Employ graph algorithms for physical design.
4. Develop tools for CAD-VLSI.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit -I:

BASIC MOS TECHNOLOGY

Integratedcircuit'sera, Enhancement and depletion mode MOS transistors.Nmos fabrication.CMOS fabrication. Introduction to BiCMOS technology. Production of E-beammasks.

Unit -II:

MOS TRANSISTOR THEORY:

Introduction, MOS Device Design Equations(Drain current equations), The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, Pass transistors and Transmission Gate, TristateInverter.

Unit- III:

Graph algorithms for physical design:

Classes of graphs, graph related to a set of lines, graph related to a set of rectangles, graph problems in physical design, maximum clique and minimum colouring, max k- independent set algorithm, algorithms for circle graphs

Unit -IV:

Partitioning algorithms:

Design style specific partitioning problems, group migrated algorithms, simulated annealing and evolution, floor planning and pin assignment, routing and placement algorithms.

RECOMMENDED LEARNING RESOURCES:

1. DouglasA.Pucknell & Kamran Eshraghian,Basic VLSI Design-,PHI 3rd Edition(original Edition – 1994),2005.
2. Neil H. E. Weste, K. Eshragian Principles of CMOS VLSI Design: A Systems Perspective, 3rd edition, PearsonEducation
3. John wiley& sons, chichester, Algorithms for VLSI design automation
4.Sherwani, Naveed A,Algorithms for VLSI physical design automation

REFERENCES:

1. R.Jacob Baker. CMOS Circuit Design, Layout and Simulation.John Wiley IndiaPvt.Ltd,2008
2. Fundamentals of Semiconductor Devices, M. K. Achuthan and K.N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi,2007.
3. CMOS Digital Integrated Circuits: Analysis and Design, Sung-MoKang & Yusuf Leblebici,3rdEdition, TataMcGraw-Hill Publishing Company Ltd., New Delhi,2007.
4. Analysis and Design of Digital Integrated Circuits - D.A Hodges,H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi,2007.
5. Hand book of algorithms for physical design automation - Charles J. Alpert, Dinesh P. Mehta, Sachin S. Sapatnekar, CRC press 2008.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F7430	Multimedia Computing & Networks	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce multimedia components and quality of service.
2. Explain different multimedia operating system modules.
3. Describe Network Services and Protocols for Multimedia Communications.
4. Provide insight on Multimedia over Wireless and Mobile Networks.

COURSE OUTCOMES:

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

1. Identify the requirements and constraints for a good Quality of service in multimedia environment.
2. Make use of multimedia operating systems concepts to solve given real world application.
3. Develop Internet Telephony using Network Services.
4. Develop Internet Telephony using Protocols for effective Multimedia Communications.

CO PO & PSO MAPPING:

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

COURSE CONTENTS:

Unit- I:

Introduction - Interdisciplinary Aspects of Multimedia, Quality of Service, Multimedia Operating Systems, Multimedia Networking and Communication, Synchronization.

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

Unit- II:

Multimedia Operating Systems - Process Management, Real-Time Processing Requirements, Traditional Real-Time Scheduling, Real-time Scheduling: System Model, Soft-Real-Time Scheduling Concepts, Scheduling Policies, Prototype Operating Systems, Interposes Communication and Synchronization, Memory Management, Reservation Concept for Memory Management, Buffer Management Techniques, Buffer Management for Client/Server Systems, Device Management, System Architecture, UNIX-based Systems, QuickTime, Windows Multimedia Extensions, OS/2 Multimedia Presentation Manager/2.

Media Server - File Systems, Memory Management

Unit- III:

Network Services and Protocols for Multimedia Communications - Protocol Layers of Computer Communication Networks, Local Area Network and Access Networks, Internet Technologies and Protocols, Multicast Extension, Quality-of-Service for Multimedia Communications, Protocols for Multimedia Transmission and Interaction, Case Study: Internet Telephony

Internet Multimedia Content Distribution - Proxy Caching, Content Distribution Networks (CDNs), Broadcast /Multicast Video-on-Demand

Unit- IV:

Internet Multimedia Content Distribution - Broadcast/Multicast for Heterogeneous Users, Application- Layer Multicast, Peer-to-Peer Video Streaming with Mesh Overlays, HTTP-Based Media Streaming.

Multimedia Over Wireless and Mobile Networks - Characteristics of Wireless Channels, Wireless Networking Technologies, Multimedia Over Wireless Channels, Mobility Management.

RECOMMENDED LEARNING RESOURCES:

1. Li,Ze-Nian,Drew,MarkS.,Liu,Jiangchuan,"Fundamentals of Multimedia",Springer,2014.
2. Steinmetz,Ralf,Nahrstedt,Klara,"Multimedia Systems"Springer,2004

REFERENCES:

1. Fred Halshall "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson education,2007.
2. R.Steimnetz,K.Nahrstedt,"Multimedia Computing,Communications and Applications",Pearson Education.2008.
3. KR.Rao,ZS Bojkovic,DAMilovanovic,"Multimedia Communication Systems:Techniques, Standards,and Networks",PearsonEducation2007.
4. Introduction to Multimedia Networks, Andrew W.Davis
5. Rao, Bojkovic, Milovanovic: Introduction to Multimedia Communications, Wiley & Sons, Hoboken, NJ,2006
6. IEEE, IEEE Transactions on Multimedia.
7. ACM, ACM Transactions on Multimedia Computing, Communications, and Applications
8. Elsevier, Elsevier Journal on Multimedia Computing.Springer, Springer Journals on Communication Networks

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F7440	Web Technology	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce essentials of Web technology
2. Comprehend the importance of CSS in designing a creative and dynamic website and embedding Java Script code in HTML.
3. Explain PERL and CGI Programming in Internet Programming
4. Discuss building the connectivity of webpages with databases using PHP

COURSE OUTCOMES:

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

1. Understand and use different tags used for creation of website
2. Develop a well formed XML document and a dynamic webpage by the use of java script and DHTML
3. Apply PERL and CGI programming for server side programming in Web
4. Build server side application to catch form data sent from client and store it on database

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-1:

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration - Namespaces JavaScript andXML

Unit-2:

Style Sheets: Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions,Constructors.

Unit-3:

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format;

CGI.pm module; Cookies. Database access with Perl and MySQL

Unit-4:

Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables.

RECOMMENDED LEARNING RESOURCES:

- Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education.
- Jeffrey C.Jackson,"WebTechnologies—A Computer Science Perspective",Pearson Education,2007.

REFERENCES:

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education,2006.
2. Marty Hall and Larry Brown, “Core Web Programming” Second Edition, Volume I and II,
3. Pearson Education,2001.
4. Bates, “Developing Web Applications”, Wiley, 2006.
5. International Journal of Web Technology-ISSN:2278-2389
6. International Journal of Web & Semantic Technology(IJWesT)
7. ELSEVIER Journals with in"Internet And Web Technology”

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F7450	Computer Graphics and Visualization	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce basics of computer graphics and OpenGL concepts.
2. Illustrate computer graphics techniques, focusing on 2D and 3D modeling, Image synthesis, and rendering using OpenGL.
3. Demonstrate interactive programs and animation using OpenGL.Provide knowledge about Projections, Transformations, lighting and shading graphic objects using OpenGL.
4. Illustrate the concepts of clipping occurs in viewing. Provide the light effects to the created graphical world and resultant shades of an object.

COURSE OUTCOMES:

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

1. Implement fundamental algorithms for drawing various basic primitives.
2. Design and Develop 2D and 3D computer graphics programs using OpenGL.
3. Design and Develop Interactive programs and animation using OpenGL. Analyze and Apply Projections, Transformations, and lighting & shading techniques for various computer graphic applications.
4. Develop the clipping algorithms for the kind of viewer and object. Implement the lighting to created scene to produce the shades relation with light source.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction to Computer Graphics and OpenGL: An Applications oriented survey of computer graphics; An Overview of graphics system – Input Devices, pixels and frame buffer, Output Devices, Raster Scan Systems, Graphics Workstations, Hard copy devices; Imaging Systems; The synthetic camera model; Graphics architectures; Graphics Software; Introduction to OpenGL; coordinate reference system; OpenGL POINT functions; The 2-D Sierpinski gasket using points;

Unit- II:

OpenGL Implementation: OpenG LLINE functions; Line Drawing algorithms–DDA, Bresenham's; setting frame buffer values, OpenGL CURVE Functions; circle generating algorithms; OpenGL POLYGON functions; 3D-Sierpinski gasket ; PIXEL-ARRAY Functions; Display Lists; Programming Event Driven Input; Menus; Point, Line and Character Attributes; Antialiasing, OpenGL antialiasing functions.

Unit-III:

Geometric Objects and Transformations: Basic two dimensional geometric transformations, matrix representations and homogeneous coordinates, inverse transfromations, 2-D composite transformations, reflection and shear, three dimensional tranformations– translation, scale and rotate, OpenGL functions for

transformations.

Viewing: Classical Views, Two Dimensional Viewing Pipeline, Three Dimensional Viewing Pipeline, 3D Viewing Coordinate Parameters, OpenGL Viewing Fucntions, Projections-Orthogonal and Perspective.

Unit-IV:

Clipping: Clipping Window coordinates, LineClipping, Cohen Sutherland Line Clipping and Liang Barsky Line Clipping.

Lighting and Shading: Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

RECOMMENDED LEARNING RESOURCES:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education,2004.
2. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education,2009.

REFERENCES:

1. Tom McReynolds**;** Advanced Graphics Programming Using OpenGL; Series in Computer Graphics;2005.
2. Ramakrishnan Mukundan; Advanced Methods in Computer Graphics With examples in OpenGL; Springer-Verlag London Limited;2012.
3. Dave Shreiner et al; OpenGL Programming Guide. The Official Guide to Learning OpenGL; Version 4.3;2013.
4. IEEE,IEEE Transactions on Visualization and Computer Graphics(TVCG)
5. ACM,ACM Transactions on Graphics(TOG)
6. World Scientific,International Journal of Image and Graphics(IJIG)
7. ACM,Journal of graphicstools

LAB EXPERIMENTS:

Part A:

Generate the following programs using OpenGL

1. A mechanic person wanted to create a mechanical wahser by recursive subdivision of gasket paper. The washer contains the holes in the form of tringles. Write a program for the same in2D.
2. The Vishwanath Anand is famous for Chess so called Chaturanga game. It is played between two kingdoms, king commands the army to defeat the opposite until to reach the King. Generate a program to create a chess board with alternative colors of your wish, using DDA line algorithm.
3. Usually we represent the database structure in computer science as Cylinders because the hard disks were manufactured by placing too many Circle shaped disks one above the other. Now write a Program to create a circle using midpoint circle generation algorithm then shaped as cylinder on any event driven input from user.
4. Mirror is best imitation of anybody (object) but in reverse direction. The size of original object and mirror image remains same or different based on distance. Now consider a cube kind of object provide mirror images of it via axes. Also try to rotate it on a fixed point without using built in functions.
5. In a manufacturing process, the parts of a machine of same shape will be resized less or more based on the fittings and usage. The spare parts will also bent to any direction to setup final model. The spare item can be like a square, do generate the program where we can resize and shear the object in any direction.
6. See what you can, gain (capture) how much fall in to your capacity (range), rest must be neglected. Try to animate this scenario using the Cohen-Sutherland line-clipping algorithm.
7. A kid wanted to draw a filled box in square shape. First kid draws all boundary lines of square box, then started filling from one side with his color that he loves. Try to simulate this using scan-line area filling algorithm make use of mouse event to fill, optionally move event.
8. In a study room visible from outside there are two walls, sports items at corner like ball and cricket bat. A table at mid of room on which set of books, tea pot and other stuff is placed. The shadow of the objects is also visible based on direction of sun light. Write a program to animate this 3D scene.

Part B:

Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL. A report of about 10 – 12 pages on the package developed duly certified by the scho.

SOFT CORE GROUP-6:

Course Code	Course Title	Duration	Course	L	T	P	C	Hrs./
BTCS15F7510	Human Computer Interaction	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of the course are to:

1. Describe basic theories, tools and techniques in HCI.
2. Explain the fundamental aspects of designing and evaluating interfaces.
3. Practice a variety of simple methods for evaluating the quality of a user interface.
4. Apply appropriate HCI techniques to design systems that are usable by people.

COURSE OUTCOMES:

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

1. Identify the suitable positioning and pointing device to be used to work with the given application.
2. Develop the user interface by Selecting an effective style for the given real-world applications.
3. Make use of different UI design rules to develop a user interface for a realworld application.
4. Compare the different evaluation techniques used to measure the quality of User Interface.

CO PO & PSO MAPPING:

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	-	2	-	2	-	-	-	-	-	-	-	3	3	3
CO4	3	-	2	-	2	-	-	-	-	-	-	-	3	3	3

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

COURSE CONTENTS:

Unit – I:

Introduction and the graphical user interface: Importance of user Interface, definition, importance of good design, benefits of good design, a brief history of Screen design, popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user Interface popularity, characteristics-Principles of user interface.

Unit – II:

Design process: Human interaction with computers, importance of human characteristics human consideration, human interaction speeds, and understanding business junctions.

Unit – III:

Screen Designing: Design goals, screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis presentation, information simply and meaningfully, information retrieval on web, statistical graphics, technological consideration in interface design.

Unit – IV:

Software tools and Interaction Devices: Specification methods, interface, building tools, keyboard and function

keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

RECOMMENDED LEARNING RESOURCES:

1. Wilbert O Galitz, The essential guide to user interface design, Wiley Dreama Tech.
2. Ben Shneidermann,Designing the user interface. 3rd Edition, Pearson Education Asia.

REFERENCES:

1. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 4th Edition,Wiley
2. Julie A. Jacko, Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition, CRC Press
3. M.G. Helander T.K. Landauer P.V. Prabhu, Handbook of Human-Computer Interaction, 2nd Edition, Elsevier
4. Gerard Jounghyun Kim, Human–Computer Interaction: Fundamentals and Practice, CRC Press.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F7520	Wireless and Mobile Networks	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describes the basics of wireless communication technology.
2. Illustrates the protocols, standards and architecture for personal area networks.
3. Describe different types of networks based on wireless technology.
4. Discuss the advanced networks and applications of wireless and mobile networks.
5. Summaries the benefits and challenges in the area of wireless and mobile communication.

COURSE OUTCOMES:

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

1. Outline the fundamental concepts of wireless communication.
2. Compare the working of wireless network and wireless Ad-hoc network.
3. Make use of the Wireless Application protocol in a real world application.
4. Develop applications using the wireless technologies.

CO PO & PSO MAPPING:

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	-
CO4	3	-	2	-	2	-	-	-	-	-	-	-	3	3	-

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

COURSE CONTENTS:

Unit- I:

Review of fundamentals of wireless communication and networks: Wireless communication channel specifications, wireless communication systems, wireless networks, switching technology, communication problems, wireless network issues and standards.

Unit-II:

Wireless body area networks, Wireless personal area networks: Properties, network architecture, components, technologies, design issues, protocols and applications, Architecture, components, requirements, technologies and protocols, Bluetooth and Zigbee.

Unit-III:

Wireless LANS, WMANs, WWANs: Network components, design requirements, architectures, IEEE 802.11x, WLAN protocols, 802.11p and applications, IEEE 802.16, architectures, components, WiMax mobility support, protocols, broadband networks and applications, Cellular networks, Satellite networks, applications.

Unit-IV:

Wireless adhoc networks: Mobile adhoc networks, Sensor networks, Mesh networks, VANETs, DTN, 4G.

RECOMMENDED LEARNING RESOURCES:

1. S.S. Manvi,M.S. Kakkasageri,“Wireless and Mobile Network concepts and protocols”,Wiley, First edition,2016.
2. P.Kaveh,Krishnamurthy,“Principles of wireless networks:Aunified approach”,PHI,2006.

REFERENCES:

1. Rappaport ,”Wireless communication”,Pearson Education India,2009
2. Ivan Stojmenovic, "Handbook of Wireless networks and Mobile Computing", Wiley,2009.
3. P. Nicopolitidis, M. S. Obaidat, et al, "Wireless Networks", Wiley,2009.
4. Bing Lin, ImrichChlamtac, "Wireless and Mobile Network Architectures", Wiley,2009.
5. Mullet, "Introduction to Wireless Telecommunication Systems and Networks", Cengage,2009.
6. WilliamStallings,“WirelesscommunicationandNetworks”,second edition,2005.
7. ACM, ACM transactions on Networking.
8. IEEE, IEEE transactions on Mobile Computing.
9. ACM, ACM transactions on Mobile Computing.
10. Elsevier, Journal on Adhoc Networks.
11. Elsevier, Journal on Network and Computer applications.

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F7530	Programming with Python	14	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the fundamentals of python statements like statements, functions, exceptions, errors, scripts, Data Types, Files and Dictionaries
2. Demonstrate the Parsing of regular expressions
3. Illustrate the features of Object-oriented programming and files
4. Discuss the features of NumPy.

COURSE OUTCOMES:

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

1. Make Use of fundamentals of python like statements, functions, exceptions, errors, scripts, Data Types, Files and Dictionaries in real world applications.
2. Develop a program to illustrate the parsing of given regular expressions
3. Apply the object-oriented features and operations of files in real world applications.
4. Design programs to make use NumPy packages.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction to Python: Installing Python: Installing on MS Windows; Installing on Mac OS X, Installing on Ubuntu Linux, Installing on Other Platforms, Using the Python Shell, Python Editors and IDES.

Your First Python Program: Diving in; Declaring Functions; Optional and Named Arguments, Writing Readable Code, Documentation Strings, The import Search Path, Everything Is an Object, What's an Object?, Indenting Code, Exceptions, Catching Import Errors, Unbound Variables, Running Scripts.

Native Datatypes: Booleans, Numbers, Coercing integers to Floats and Vice Versa, Fractions, Trigonometry, Numbers in a Boolean Context, Lists, Tuples, Sets, Dictionaries.

Comprehensions: Working with Files and Dictionaries, List Comprehensions, Dictionary Comprehensions, Set Comprehensions.

Unit-II:

Strings: Unicode, Diving In, Formatting Strings, Compound Field Names, Format Specifiers, Other Common String Methods, Slicing a String, Strings versus Bytes, Character Encoding of Python Source Code.

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, Verbose Regular Expressions, Case Study : Parsing Phone Numbers.

Unit-III:

Classes and Iterators: Defining Classes, The_init_() Method, Instantiating Classes, Instance Variables, A Fibonacci Iterator, A Plural Rule Iterator.

Advanced Iterators: Finding all occurrences of a Pattern, Finding the Unique items in a sequence, Making Assertions, Generator Expressions, Calculating Permutations, Other Fun stuff in the itertools Module, A new kind of string Manipulation, Evaluating Arbitrary Strings as Python Expressions.

Files: Reading from Text Files, Writing to text files, Binary Files, Streams Objects from Non-file Sources, Standard Input, Output, and Error.

Unit-IV:

NumPy: Origin of NumPy, Object Essentials: Data type Descriptors, Basic Indexing, memory layout of nd array, universal functions of arrays, summary of new features, The Array Object: nd array attributes, nd array methods, array special methods, array indexing.

Implementation of Machine Learning Algorithms: Linear Regression, K-Means Clustering Algorithm.

RECOMMENDED LEARNING RESOURCES:

1. Mark Pilgrim, Dive into Python, Copyright (C) 2000 Free Software Foundation.
2. Travis E. Oliphant,Guide to NumPy, trelgol publishers,2006.

REFERENCES:

1. Mark Lutz, Learning Python,Oreilly.
2. John M. Zelle, PYTHON Programming: An Introduction to Computer Science, Franklin, Beedle & Associates.
3. MichaelDawson,PythonProgrammingfortheAbsoluteBeginners,3rdEdition,CENAGELearning.
4. Wesley J. Chun, Core Python Programming, 2nd Edition, PrenticeHall.
5. Steve Holden and David Beazley, Python Web Programming, NewRiders.
6. Springer, Kent D. Lee, Python Programming Fundamentals, 2ndEdition.
7. John V. Guttag, Introduction to Computation and Programming using Python, MITPress.

LAB EXPERIMENTS:

1. Write a Python program that reads input from the keyboard. The input will consist of some number of lines of text. The input will be terminated by a blank line. Your program should print every thirdline.
   For instance, if the input is the following:
   "Spot the mistake in the following
   argument", Jack challenged
   1+(-1+1)+(-1+1)+... = (1+ -1)+(1+ -1)+...
   so
   therefore,
   1 = 0
   ??
   then the output should be:
   Jack
   challenged 1
   = 0

2. "99 Bottles of coke" is a traditional song. It is popular to sing on long trips, as it has a very repetitive format which is easy to memorize, and can take a long time to sing. The song's simple lyrics are as follows:
   99 bottles of coke on the wall, 99 bottles of coke.
   Take one down, pass it around, 98 bottles of coke on the wall.
   The same verse is repeated, each time with one fewer bottle. The song is completed when the singer or singers reach zero. Your task here is to write a Python program capable of generating all the verses of the song.

3. Write a function matched(s) that takes as input a string s and checks if the brackets "(" and ")" in s are matched: that is, every "(" has a matching ")" after it and every ")" has a matching "(" before it. Your function should ignore all other symbols that appear in s. Your function should return True if s has matched brackets and False if it does not. Here are some examples to show how your function should work.

```
>>> matched("zb%78")
True
>>>
matched("(7)(a")
False
```

4. In cryptography, a Caesar cipher is a very simple encryption techniques in which each letter in the plain text is replaced by a letter some fixed number of positions down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on. The method is named after Julius Caesar, who used it to communicate with his generals. ROT-13 ("rotate by 13 places") is a widely used example of a Caesar cipher where the shift is 13. In Python, the key for ROT-13 may be represented by means of the following dictionary: key = {'a':'n', 'b':'o', 'c':'p', 'd':'q', 'e':'r', 'f':'s', 'g':'t', 'h':'u', 'i':'v', 'j':'w', 'k':'x', 'l':'y', 'm':'z', 'n':'a', 'o':'b', 'p':'c', 'q':'d', 'r':'e', 's':'f', 't':'g', 'u':'h', 'v':'i', 'w':'j', 'x':'k', 'y':'l', 'z':'m', 'A':'N', 'B':'O', 'C':'P', 'D':'Q', 'E':'R','F':'S', 'G':'T', 'H':'U', 'I':'V', 'J':'W', 'K':'X', 'L':'Y', 'M':'Z', 'N':'A', 'O':'B', 'P':'C', 'Q':'D', 'R':'E', 'S':'F', 'T':'G', 'U':'H', 'V':'I', 'W':'J', 'X':'K', 'Y':'L', 'Z':'M'} Your task is to implement an encoder/decoder of ROT-13. Once you're done, you will be able to read the following secret message:Pnrfnepvcure? V zhpucersrePnrfnefnynq!

5. A bank needs an application to keep track of the customer's account balance. The customer has name and balance as the attributes. Build the application to have a class customers, with the following methods:
   set_balance
   withdraw
   deposit
   check_balan
   ce

6. Define three classes: Bear , Rabbit , and Octothorpe . For each, define only one method: eats() . This should return 'berries' (Bear), 'clover' (Rabbit), or 'campers' (Octothorpe). Create one object from each and print what iteats.

7. Define a simple "spelling correction" function correct() that takes a string and sees to it that 1) two or more occurrences of the space character is compressed into one, and 2) inserts anextra
   space after a period if the period is directly followed by a letter. E.g. correct("This is very funny and cool.Indeed!") should return "This is very funny and cool. Indeed!" Tip: Use regular expressions!

8. HTMLParser which serves as the basis for parsing text files formatted in HTML (HyperText Mark-up Language) and XHTML. Write a program to illustrate all the methods in the parserclass

9. WriteaprogramtouseDOMAPI'stoparsemovies.xmlfile.Thephrasecallstheparse(file [,parser]) function of the minidom object to parse the XML file designated by file into a DOM treeobject.

10. Implement a function which lets you define parsers that take any input source (URL, pathname to local or network file, or actual data as a string) and deal with it in a uniform manner. Returned object is guaranteed to have all the basic stdio read methods (read, readline, readlines). Just .close() the object when you're done withit.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F7540	Cloud Security	16	SC	3	1	0	3	3

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide the ground-up coverage on the high level concepts of cloud landscape, architectural principles, techniques, design patterns and real-world best practices applied to Cloud service providers and consumers and delivering secure Cloud based services.
2. Describe the Cloud security architecture and explore the guiding security design principles, design patterns, industry standards, applied technologies and addressing regulatory compliance requirements critical to design, implement, deliver and manage secure cloud based services.
3. Delve deep into the secure cloud architectural aspects with regards to identifying and mitigating risks, protection and isolation of physical & logical infrastructures including compute, network and storage, comprehensive data protection at all OSI layers, end-to-end identity management & access control, monitoring and auditing processes and meeting compliance with industry and regulatory mandates.
4. Leverage cloud computing security guidelines set forth by ISO, NIST, ENISA and Cloud Security Alliance(CSA).

COURSE OUTCOMES:

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

1. Choose the suitable cloud deployment model for storage of data pertaining to given applications.
2. Build a cloud security infrastructure using computer programming and configuration skills.
3. Identify the security management issues in the cloud with respect to SaaS, IaaS and PaaS.
4. Make use of various security policies for implementation of given real world problem.

CO PO & PSO MAPPING:

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	-
CO4	3	-	2	-	-	-	-	-	-	-	-	-	3	3	-

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

COURSE CONTENTS:

Unit – I:

Fundamentals of Cloud Computing and Architectural Characteristics: Understand what is Cloud computing? ; Architectural and Technological Influences of Cloud Computing; Understand the Cloud deployment models: Public, Private, Community and Hybrid models; Scope of Control: Software as a Service (SaaS); Platform as a Service (PaaS); Infrastructure as a Service (IaaS); Cloud Computing Roles Risks and Security Concerns

Security Design and Architecture for Cloud Computing: Guiding Security design principles for Cloud Computing; Secure Isolation o Comprehensive data protection; End-to-end access control; Monitoring and auditing; Quick look at CSA, NIST and ENISA guidelines for Cloud Security; Common attack vectors and threats

Unit – II:

Secure Isolation of Physical & Logical Infrastructure: Isolation; Compute, Network and Storage; Common

attack vectors and threats; Secure Isolation Strategies: Multitenancy, Virtualization strategies; Inter-tenant network segmentation strategies; Storage isolation strategies

Data Protection for Cloud Infrastructure and Services: Understand the Cloud based Information Life Cycle ; Data protection for Confidentiality and Integrity; Common attack vectors and threats; Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key Management, Assuring data deletion; Data retention, deletion and archiving procedures for tenant data; Data Protection Strategies

Unit – III:

Enforcing Access Control for Cloud Infrastructure based Services: Understand the access control requirements for Cloud infrastructure; Common attack vectors and threats; Enforcing Access Control Strategies; Compute, Network and Storage; Authentication and Authorization; Roles-based Access Control, Multi-factor authentication; Host, storage and network access control options; OS Hardening and minimization, securing remote access, Verified and measured boot; Firewalls, IDS, IPS and honeypots

Monitoring, Auditing and Management: Proactive activity monitoring, Incident Response; Monitoring for unauthorized access, malicious traffic, abuse of system privileges, intrusion detection, events and alerts; Auditing – Record generation, Reporting and Management; Tamper-proofing audit logs; Quality of Services; Secure Management; User management; Identity management; Security Information and Event Management

Unit – IV:

Introduction to Cloud Design Patterns: Introduction to Design Patterns; Understanding Design Patterns Template; Architectural patterns for Cloud Computing; Platform-to-Virtualization & Virtualization-to- Cloud; Cloud bursting

Introduction to Identity Management in Cloud Computing: User Identification, Authentication, and Authorization in Cloud Infrastructure; Single Sign-on; Identity Federation; Identity providers and service consumers; the role of Identity provisioning

RECOMMENDED LEARNING RESOURCES:

1. Vic (J.R.) Winkler, Securing The Cloud: Cloud Computing Security Techniques and Tactics Syngress/Elsevier -978-1-59749-592-9
2. Thomas Erl , Cloud Computing Design Patterns , Prentice Hall -978-0133858563

REFERENCES:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly Media, September 2009
2. Ronald L Krutz, Russel Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing ©2010, ISBN:047058987697804705898769780470589878
3. Yeluri,Raghuram,Castro-Leon,Enrique,Building the Infrastructure for Cloud Security A Solutions View, Apress,2014.
4. John Rhoton, Cloud Computing Protected: Security Assessment Handbook,2013.
5. Tim Sandage, Ted Steffan, Automating Cloud Security - Modernizing Governance through Security Design, O'Reilly Media, October 2016.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F7600	Cloud Computing Lab	16	HC	0	0	2	2	4

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide the knowledge of Map Reduce framework in solving problems related to Bigdata.
2. Introduce IOT applications using Cloud.
3. Provide hands on experience on cloud environments.
4. Introduce examples on cloud security.

COURSE OUTCOMES:

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

1. Execute MapReduce programs on Hadoop and analyse the results.
2. Carry out IOT applications using Cloud.
3. Conduct some simple experiments on VMware products.
4. Conduct some simple experiments on cloud security using encryption techniques.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1. Evaluate the performance of MapReduce program on word count for different file size.
2. Design a document, excel sheet, presentation and form using Google Docs, Google sheets, Google Slides and Google Forms.
3. Create multiple VM's on a single physical machine. Provide a communication between them using and without using vClient.
4. Demonstrate the communication of VM's on different physical devices using ESXI.
5. Illustrate the cloning of VM's.
6. Illustrate the backup-restore scenario.
7. Add iSCSI adapter and modify the relative parameters. Create a new VMkernel using iSCSI port binding.
8. Performance Analysis of Virtual Machine vs Physical Machine.
9. Design a module to control an LED from Webserver using NodeMcu or Esp8266 programming with Arduino IDE.

ADDITIONAL PROGRAMS:

1. Create a data center using vCenter for multiple VM's.
2. Install and configure the vSphere Web client.
3. Illustration of vMotion to move the VM's from one ESXi to another ESXi
4. Design and Demonstrate a program using CloudSim, showing how to create a datacenter with one host and run one cloudlet on it
5. Design and Demonstrate using CloudSim, showing how to create two datacenters with one host each and run cloudlets of two users on them.

RECOMMENDED COURSE RESOURCES:

1. http://hadoop.apache.org/
2. https://www.macalester.edu/~shoop/sc13/hadoop/html/hadoop/wc-detail.html
3. https://en.wikipedia.org/wiki/K-means_clustering
4. https://github.com/himank/K-Means
5. https://www.arduino.cc/
6. https://www.arduino.cc/en/Main/arduinoBoardUno
7. https://en.wikipedia.org/wiki/Arduino
8. www.arduino.org/
9. *www.vmware.com*
10. http://www.vmware.com/products.html

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F7700	Web Application Lab	16	HC	0	0	2	2	4

COURSE OBJECTIVES:

The objective of this course areto:

1. Provide the knowledge and skills required to design and implement web pages and web applications.
2. Introduce the concepts of Client &Server Side Programming, Active Server Pages, Database Connectivity to web applications, Adding Dynamic content to web applications, Programming Common Gateway Interfaces, Programming the User Interface for the web applications.
3. Enforce a practical orientation to web application development through the concepts of web programming languages and impart knowledge about data handling through XML concepts.

COURSE OUTCOMES:

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

1. Get the knowledge on Basic concepts of web programming.
2. Acquire perl and PHP Programming knowledge.
3. Get the knowledge of Client server connection and data retrieval.
4. Develop user-interfaces for Web Applications and Web Services.

CO PO & PSO MAPPING:

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

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

LAB EXPERIMENTS:

1. In todays 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 a static web pages for an online Book store. The pages should resemble like *www.amazon.com* the website should consist of. Home page, Registration & Login, User profile page, Books catalog, Shopping cart, Payment by credit card, and order confirmation.

2. Internet or online services works on clients and server model. A client is a web browser through which users make requests, which contain input required, for service from the server to perform tasks. Server is a program running on a dedicated computer. Performance of any service or server depends on its throughput. Server throughput deteriorates when users send more and more invalid requests for service and thus results in wastage of server resources that are very precious. As a solution to this problem design a web page that takes student details such as Name, branch, Semester, University, date of admission, mobile number, email id and check for validity or correctness of the input data by writing a JavaScript to validate these fields.

3. Clients interact with servers by sending service requests that contain input required to complete the requested task or service. Input required for requested service may be collected through a web page, that acts as an interface between users and the server, in the form of text fields, text areas, radio buttons, push buttons and so on. Hence it is better to instruct or help clients to input correct data through web page by displaying

appropriate error messages or alerts as and when users supply wrong input using event handlers. To demonstrate this task, design and develop a web page using Javascript, XHTML that collects the SRN (Valid format is: Any letter followed by two digits, followed by two letters then followed by three digits). Include event handler for the form elements that collects information to validate the input. Messages must be produced in the alert windows as and when errors are detected**.**

4. Dynamic web content is the information that is retrieved from one or more web servers depending upon what information client have requested for, and composed in response to users' requests. Advanced web technologies play a vital role in storage, processing and retrieval of dynamic web content from web servers. Hence it is important to use advanced web technologies such as XML to improve the efficiency in data retrieval. Create and save XML document for student's information and display the same using cascaded stylesheet.

5. Information technology has become part and parcel of humanity to such an extent that people can shop anything online, from anywhere, at anytime using an electronic device that has access to Internet. This has brought in the concept of virtual stores which provide products at less cost. To improve sales it is mandatory to organize items catalog based on item name, item price, and manufacturer so on. For such online shopping sites, look and feel is an obvious requirement which can be achieved using CSS & XSLT. Design a document using CSS and XSLT to create a catalog of items for an online electronic shopping.

6. In any business organization, employees keep traveling across different geographical locations and at thesametimetheywanttobeconnectedtotheirorganization'scomputingresourcessuchasemail server, database server, file server, etc. to retrieve information such as sales details, assigning tasks to employees, and upload inspection site details, so on. Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition and publisher and store information submitted through web page in MySQL database. Design another web page to search for a book based on book title specified by the user and displays the search results with proper headings.

7. Using computers without graphical user interfaces require the knowledge about syntax of computer commands and programming languages, also this makes users to feel that the use of computers is difficult and cumbersome. This impression of users on computers can be changed by providing good and easy-to-use graphical user interfaces which play vital role in use of computer applications or software without worrying about syntax of programming languages or computer commands. In fact computer software with good and easy-to-use graphical user interfaces will have large number of users.
a) Design HTML page that takes UNIX command as input in a text field and submit it to a Perl program that executes given command and display the output on the web page b) Write a Perl program to keep track of the number of visitors to a webpage and display the count of visitors with proper headings.
8.Databases are the storage systems used by most of the business and information technology enterprises as back end. When users generate data using GUI, for ex. personal information, data are sent to back end database for storage and also users can retrieve this data as and when required from the back end (database) to the front GUI. In the real world there are several databases such as Oracle, DB2, MySQL, SQL Server, MS-Access, DBMongo, etc. To illustrate the process of generating data from the front end and store it on back end database then retrieve the available data from the back end database, write a Perl program to read personal information of a person such as firstname, lastname, age, permanent address and pin code entered by the user into a table created in MySQL. Read the same information from the database and display on the front end.

First Name	Last Name	Age	Address	Pincode
Ram	Kumar	21	REVA University	560064
Anil	Vinay	30	REVA University	560064

9. Internet consists of several domains that are identified by different network addresses. To serve better its users, Internet makes use of java servlets which help HTTP protocol in reducing the response time. To demonstrate the use of servlets write java program to create a simple servlet that display "Hello World!" message.

10. Today the world has become flattened due to the evolution and wide spread use of Internet. Any server

such as email server, file server, database server, remote access, telnet, and authentication must be capable of serving hundreds of thousands client requests simultaneously with minimum latency. It is possible to design and develop servers with such capability only if software architects use advanced technologies such as Java servlets and Java server pages. For example, design and develop HTTP servlet that asks users to input username and password, and redirects the user to the appropriate page(Ex: Home page upon successful login or to error page in case of login failure).

ADDITIONAL PROGRAMS:

1. HTTP sessions are the connections, with unique identifiers, maintained by the HTTP servers between HTTP server and HTTP client for the duration between user login and logout. In a multiuser environment servers could be able to differentiate and uniquely identify users using unique session identifiers. Information can be stored using HTTP sessions on page, user and application basis. Write a program to create HTTP session object, display session id, session creation time, last accessed time, user id to which session belongs to, and number of visits.

2. As the number of Internet users increase, it is imminent to develop advanced technologies to meet the requirements, less response time and resource consumption, of its users. Internet uses client-server model to support communication between server and client. JSP is a matured technology in terms of response time and resource consumption compared to HTTP servlets in serving clients. Using JSP, design and develop a program using java server pages to print text message to demonstrate JSP technology

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS16F7800	Project Work Phase-1	16	HC	0	0	2	2	4

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:

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 giv e an oral presentation.

COURSE OUTCOMES:

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

CO PO & PSO MAPPING:

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 school of CSE as an internal project guide based on research domain and expertise. Student may optionally also select external guide bearing domain expertise from different schools 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

VIII Semester Syllabus

EIGHT SEMESTER:

SOFT CORE GROUP-7:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8110	Storage Area Networks	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the need and issues of information storage systems.
2. Introduce Storage Networking Technologies and Virtualization.
3. Discuss various types of storage networking technologies and virtualization.
4. Explain the concept of Business continuity and replication.
5. Describe the features like replication, security that enable storage area networks to be reliable.
6. Explain the security measures required for storage systems.

COURSE OUTCOMES:

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

1. Evaluate the need for storage systems and identify types of storage systems.
2. Illustrate various storage area networks and compare their features.
3. Formulate a storage solution for a case study.
4. Apply security features to a given storage area network case study.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit- I:

Storage System: Introduction to Information Storage and Management; Storage System Environment; Data Protection: RAID; Intelligent Storage System.

Unit- II:

Storage Networking Technologies and Virtualization: Direct-Attached Storage and Introduction to SCSI; Storage Area Networks; Network-Attached Storage; IP SAN; Content-Addressed Storage; Storage Virtualization

Unit- III:

Business Continuity: Introduction to Business Continuity; Backup and Recovery; Local Replication; Remote Replication

Unit- IV:

Storage Security and Management: Securing the Storage Infrastructure; Managing the Storage

RECOMMENDED LEARNING RESOURCES:

1. G. Somasundaram, Alok Shrivastava (Editors): Information Storage and Management, EMC Education

Services, Wiley- India,2009.
2. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2003.

REFERENCES:

1. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill,2003.
2. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India,2002.
3. IEEE,IEEE Transactions on Knowledge and Data Engineering
4. Elsevier, Big Dataresearch.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8120	Software Architectures	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objective of this course are to:

1. Provide the knowledge of Basic Software Architecture concepts.
2. Introduce the concept of Quality attributes and tactics to extract the attributes.
3. Enhance the Knowledge of various Software Architecture pattern used in projects to estimate quality.
4. Design patterns which support Software Architecture in determining quality.

COURSE OUTCOMES:

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

1. Apply the knowledge of basic Software Architecture concepts.
2. Estimate quality attributes that determine quality of the project.
3. Prepare quality tactics that enhances the quality of the attributes.
4. Create design patterns to support to build a Software Architecture.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction: The Architecture Business Cycle; where do architectures come from? Software processes and the architecture business cycle; what makes a "good" architecture? What software architecture is and what it is not; other points of view; Architectural patterns; reference models and reference architectures; Importance of software architecture; Architectural structures and views

Unit-II:

Quality: Functionality and architecture; Architecture and quality attributes; system quality attributes; quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities; Achieving quality; Introducing Tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles

Unit-III:

Architectural Patterns-1 and 2: Introduction; From mud to structure; layers; Pipes and filters; Black Board; Distributed systems; Broker; Interactive systems; MVC; Presentation Abstraction control

Unit-IV:

Architectural Patterns-3 and Design pattern: Adaptable systems; Microkernel; Reflection; Structuraldecomposition; Whole-part; Organization of work; Master-Slave; Access control; Proxy

RECOMMENDED LEARNING RESOURCES:

1. Len Bass; Paul Clements; Rick Kazman:Software Architecture in Practice;2nd Edition; Pearson Education;2003.
2. Frank Buschmann; RegineMeunier; Hans Rohnert; Peter Sommerlad; Michael Stal: Pattern- Oriented Software Architecture; A System of Patterns; Volume 1; John Wiley and Sons;2007.
3. Mary Shaw and David Garlan: Software Architecture-Perspective on and Emerging Discipline; Prenctice-Hall ofIndia;2007.

REFERENCES:

1. Eoin Woods and Nick Rozanski; Software Systems Architecture; 2nd Edition;Addison-Wesley
2. Richard N. Taylor, NenadMedvidovic, Eric M. Dashofy; Software Architecture: Foundations, Theory and Practice; Wiley India Pvt. Limited,2010
3. George Fairbanks ;Just Enough Software Architecture: A Risk-driven Approach ; Marshall & Brainerd 2010

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8130	Real Time Systems	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiarize the fundamental problems concepts and approaches in the design and analysis of real- time systems.
2. Introduce various approaches, abstract models and terminologies for real-time scheduling.
3. Outline various Priority-Ceiling Protocols used in resource sharing.
4. Impart knowledge of Real Time Operating Systems and Databases.

COURSE OUTCOMES:

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

1. Identify the fundamentals of Signal Processing and real-time systems.
2. Choose the appropriate algorithm to analyze and design a real-time system.
3. Make use of access Control in Multiple-Unit Resources to analyse, design and schedule the real-time systems.
4. Develop the applications using the characteristics of Real Time Operating Systems and Databases.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit- I:

Introduction: Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing, Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Unit- II:

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Unit-III:

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non- preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

Unit- IV:

Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases.

RECOMMENDED LEARNING RESOURCES:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication 2000.
2. MallRajib,"RealTimeSystems",Pearson Education,2007
3. AlbertM.K.Cheng,"Real-Time Systems: Scheduling, Analysis,andVerification", Wiley,2003

REFERENCES:

1. Springer, International Journal of Time-Critical Computing Systems
2. Inderscience, International Journal of Embedded and Real-Time Communication Systems
3. Research Science Press, International Journal of Embedded Systems and Computer Engineering

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8140	Mobile Computing and Application Development	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Outline and describe the fundamental concepts of mobile computing and various multiplexing techniques.
2. Introduce the fundamentals of Android Mobile application
3. Describe the Kernel & threads of Android and DEX file format
4. Impart the aspects of Android programming

COURSE OUTCOMES:

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

1. Differentiate various wireless communication technologies.
2. Identify most recent mobile application tools as well as install, configure, and use them.
3. Execute operations on GUI objects and Perform Event driven programming.
4. Develop a mini project or simple mobile applications using android operating system.

CO PO & PSO MAPPING:

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	3
CO3	-	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO4	-	3	3	-	3	-	-	-	-	3	-	-	3	3	3

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

COURSE CONTENTS:

Unit- I:

Overview of Mobile Systems: Overview of mobile landscape with some application scenarios, defining characteristics of a mobile device, intersection of mobile systems with embedded, wireless systems and application architectures. Physical Layer Concepts: Frequency spectrum, Division Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing. Basic operations of cellular systems,

Unit-II:

Introduction to Mobile Applications: Fundamental MAC protocols – FDMA, TDMA, CDMA, SDMA. Basics of GSM, GPRS. WLAN, Bluetooth.

Introduction to Android: Overview of Android; Android for Mobile Apps Development; Environment setup for Android Apps Development; Framework - Android- SDK; Eclipse; Emulators; Android Emulation and First Android Application.

Unit-III:

Android System: Android Architecture – Anatomy and Physiology. Kernel Layer: Booting, Memory Layout. Process Context, Kernel Timers. Concurrency in the kernel, Kernel threads. Hardware Block Diagram, Buses, Linux device model, Character and Block drivers. DVM Instructions, DEX file format.

Unit-IV:

Android Application Programming: Overview of application development in Android: Application components. Activating components through intents. Manifest File, Activities and Tasks. Processes and Threads. Component life cycles, Processes and Lifecycles. Android Data Storage: Using Preferences. Using the File System. Using sqlite3 tool. Content Providers. Android GUI Programming, Event driven programming. Callback functions, Multi-Thread Programming in Android.

RECOMMENDED LEARNING RESOURCES:

1. Mobile Communications – Jochen Schillier, 2nd edition, Pearson publishers.
2. Android in Action by W.FrankAbleson, Robi Sen, Chris King, Manning Publications
3. Reto Meier, Professional Android Application Development, Wiley India Pvt.Ltd.
4. Ivan Stojmenovic,Hand book of Wireless Networks and Mobile Computing,John Wiley & SonsInc., Canada, 2002.
5. L Murphy, Beginning Android Mark, Wiley India Pvt.Ltd.

REFERENCES:

1. Android Application Development in 24 Hours, Sams Teach Yourself (3rd Edition) (Sams Teach Yourself -- Hours) 3rd Edition ,Ed.Burnette.
2. Hello, Android: Introducing Google's Mobile Development Platform (Pragmatic Programmers) ThirdEdition.
3. Android Application Development All-in-One For Dummies 1st Edition,Barry A Burd.

LAB EXPERIMENTS:

1. Installation and Basics
2. Program to demonstrate Android Layouts and GUI
3. Program to demonstrate dynamic UI with fragments in Android
4. Program to demonstrate data storage in Android
5. Program to demonstrate interaction between apps in Android
6. Program to demonstrate Multimedia in Android
7. Program to demonstrate connectivity among devices using Android
8. Program to demonstrate usage of location info in Android

Problem Statement for Mini-Project:

Design an Android Application for a pharmacist. The requirements are as follows:

1. The app should contain a list of medicines and its details like cost, company etc.
2. The pharmacist should be able to record the out of stock medicines.
3. When required, the pharmacist should be able to place order to the dealer to fetch out of stock medicines.

Course Code	Course Title	Duration (Week)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8150	User Interface Design and Development	14	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Providestudentscomprehensivestudytechniquesindesignandimplementationofuser interface engineering.
2. Impart students acritical analysis of user interface design and application for communication perspective.
3. Give an insight into some interaction design patterns and their applicability.
4. Bring forward the development methodologies and development scenarios.
5. Impart students the understanding of building a graphical user interface, interaction devices and technologies, cognitive models etc.

Course Outcomes:

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

1. Describe the basic user interface engineering definitions, concepts and principles.
2. Apply user interface concepts and principles to analyses and evaluate a variety of approaches to user interface design.
3. Acquire an understanding of needs and analysis of user interface/interaction, legal, ethical, social issues.
4. Design, develop, implement and present a new user interface for an application applying concepts and principles of user interface.

CO PO & PSO MAPPING:

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	-	-	1	-	-	-	-	-	-	3	-	-	3	3	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	3	3	-

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

COURSE CONTENTS:

Unit-I:

Introduction

Usability of Interactive Systems: Introduction, Usability Requirements , Usability Measures , Usability Motivations , Universal Usability , Goals for Our Profession .

Guidelines, Principles and Theories: Introduction, Guidelines, Principles, Theories, Object-ActionInterface Model.

Development Process Managing Design processes, Social, Ethical, and Legal Issues: Introduction, Organizational Design to Support Usability, The Three Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Social Impact Statement for Early Design Review, Legal lssues

Unit-II:

Evaluating Interface Design; Control of Psychological Orientation: Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance Test, Evaluation during Active Use, Controlled Psychologically Oriented Experiments.

Interaction Styles Direct Manipulation and Virtual Environment: Introduction, Examples of Direct Manipulation, Discussion of Direct Manipulation, 3D Interfaces, Teleoperation, Virtual and Augmented Reality.

Menu selection, form filling and dialog box: Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry with Menus: Form Filling, Dialog Boxes, and Alternatives Audio Menus and Menus for Small Displays.

Unit-III:

Command and Natural language: Introduction, Functionality to Support Users 'Tasks, Command-Organization Strategies, The Benefits of Structure, Naming and Abbreviations, Natural Language in Computing.

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays-Small and Large, Printers

Unit-IV:

Collaboration and Social Media Participation: Introduction, Goals of Collaboration, Asynchronous Distributed Interfaces: Different Time, Different Place, Synchronous Distributed Interfaces: Different Place, Same Time, Face-to-Face Interfaces: Same Place Same Time

RECOMMENDED LEARNING RESOURCES:

1. Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6/E by Ben Shneiderman, Catherine Plaisant, Steven Jacobs. (2017, Pearson Education Company)

REFERENCES:

1. Steve Krug, Don't Make Me Think! A Common Sense Approach to Web Usability, New Riders, 3rd Edition,2014.ISBN-9780134380384,013438038X eText ISBN:9780134380728

LAB EXPERIMENTS:

1) Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

2) a) Develop an applet that displays a simple message.

b) Develop an Applet that receives an integer in one text field & compute its factorial value & returns it in another text filed when the button "Compute" is clicked

3) Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box

4) Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or" ready" or "go" should appear above the buttons in a selected color. Initially there is no Message shown

5) Suppose that a table named Table.txt is stored in a text file. The first line in the file header and the remaining lines correspond to row in the table. The elements are separated by commas. Write a Java programto display the table using labels in grid layout

6) Write a Java program that handles all mouse events and shows the event 40-42 name at the center of the window when a mouse event is fired. (Use adapter classes).

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8160	Optimization Techniques & Game Theory	16	SC	3	1	0	4	

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce unconstrained optimization techniques in computer communication and networks.
2. Impart appropriate optimization techniques for problems of real world scenario.
3. Analyze and design solution to various classical and modern methods for constrained and unconstrained problems in both single and multivariable.
4. Outline fundamental game theoretic notions and results relevant to applications in computer science.
5. Summarize game-theoretic models in a variety of contexts.

COURSE OUTCOMES:

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

1. Identify and summarize the need & origin of the optimization methods.
2. Elaborate the optimization problem and its various components.
3. Formulate optimization problems as mathematical programming problems.
4. Apply the methods of optimization in real world situation.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Unconstrained Optimization: Unconstrained Optimization, Constrained Optimization, Kuhn-Tucker Necessary and Sufficient conditions, Optimization, Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg-Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Liner Programming, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches –Blue.

Unit- II:

Optimization and Functions of a Complex Variable and Numerical Analysis: Euler's Method, The Modified Euler Method and the Runga-Kutta Method for Ordinary Differential Equations, Gaussian QuadratureTranzoidalRuleandSimpson's1/3and3/8Rules,theNewtonRaphsoninoneandtwo Dimensions, Jacobi's Iteration, Optimization in Operation Research, Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Heuristic Methods

Unit-III:

Game Theory: Introduction, Definition of Games. Actions, Strategies, Preferences, Payoffs, Strategic Form Games, Dominant Strategy Equilibrium, Pure Strategy Nash Equilibrium, Mixed Strategy Nash Equilibrium**,** Mixed strategy Nash equilibrium, Two Player Zero-sum Games (Matrix Games)

Unit-IV:

Extensive games with Perfect Information: Bayesian Games, Mechanism Design, Social choice functions, Direct and indirect mechanisms, Notion of incentive compatibility, Revelation theorem, Properties of social choice functions, Gibbard Satterthwaite theorem, Quasi-linear utilities, Vickrey auction, Clarke mechanisms, Groves mechanisms, Examples of VCG (Vickrey-Clarke-Groves) mechanisms, Different types of auctions, Revenue equivalence theorem, Cooperative Game Theory.

RECOMMENDED LEARNING RESOURCES:

1. Rao S.S., Optimization: Theory and Applications, John Wheily & Sons Publication, 4th edition,2009
2. Wayne L. Winston, Operations Research: Applications and Algorithms, PWS-Kent Pub. Co.,1991
3. Martin Osborne , An Introduction to Game Theory, Oxford University Press,2003.
4. Y. Narahari, Essentials of Game Theory and Mechanism Design, IISc Press, 2011(forthcoming).
5. C.H. Papadimitriou and K. Steiglitz, Combinatorial Optimization: Algorithms and Complexity, Courier Dover Publications,1998
6. Philip D. Straffin, Jr. Game Theory and Strategy. The Mathematical Association of America, January 1993.
7. Ken Binmore, Fun and Games : A Text On Game Theory, D. C. Heath & Company,1992.

REFERENCES:

1. Stamford GameTheory
2. International journal on Game Theory,Springer
3. Game Theory.net
4. journal on Game Theory, Scientific and Academic Publishers
5. IDEAS: International journal on Game Theory,Springer
6. IEEE transactions on computational intelligence and AI in games

SOFT COREGROUP-8:

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8210	Data Analytics Tools	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the fundamentals of 'R' programming.
2. Explore few statistical methods that can apply for data manipulation and importing techniques.
3. Discuss different Regression techniques.
4. Illustrate the working of clustering algorithms using R.

COURSE OUTCOMES:

1. Explain the fundamentals of R Programming Language.
2. Apply and compare basic machine learning techniques using R for data analytics.
3. Design and Implement algorithms to learn Regression techniques for data analysis.
4. Perform analytics and build models for real world data science problems.

CO PO & PSO MAPPING:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P O8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	1	3	-	-	-	3	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	3	-	-	-	-	3	3	3
CO4	3	2	2	1	3	-	-	-	-	3	-	3	3	3	3

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

COURSE CONTENTS:

Unit-I:

A brief introduction to R: An overview of R, Vectors, factors, and univariate time series, Data frames and matrices, Functions, operators, and loops. Styles of data analysis: Revealing views of the data, Data summary, Statistical analysis questions, aims, and strategies.

Unit-II:

Statistical models: Statistical models, Distributions: models for the random component, Simulation of random numbers and random samples. A review of inference concepts: Basic concepts of estimation, Confidence intervals and tests of hypotheses, Contingency tables, Re-sampling methods for standard errors, tests, and confidence intervals, Theories of inference.

Unit-III:

Regression with a single predictor: Fitting a line to data, Outliers, influence, and robust regression, Standard errors and confidence intervals, Assessing predictive accuracy. Multiple linear regression: Basic ideas: a book weight example, the interpretation of model coefficients, multiple regression assumptions, diagnostics, and efficacy measures, Astrategy for fitting multiple regression models.

Unit-IV:

Logistic Regression: Building a Linear Model for Binary Response Data, Interpretation of the Regression Coefficients in a Logistic Regression Model, Statistical Inference, Classification of New Cases, Estimation in R. Binary Classification, Probabilities, and Evaluating Classification Performance: Binary Classification, Using

Probabilities to Make Decisions, Sensitivity and Specificity, Example: German Credit Data.
Clustering: k-Means Clustering, Another Way to Look at Clustering: Applying the Expectation-Maximization(EM) Algorithm to Mixtures of Normal Distributions, Hierarchical Clustering Procedures.

LAB EXPERIMENTS:

1a. Vectors are the most basic R data objects and there are six types of atomic vectors. They are double, complex, character and raw. Write a program in R to demonstrate the use of Vector Objects

b. Factors are the data objects which are used to categorize the data and store it as levels. They can store both strings and integers. They are useful in the columns which have a limited number of unique values. Like " Male, "Female" and True, False etc. They are useful in data analysis for statistical modelling Write a program in R to demonstrate the use of Factor Objects

c. A data frame is a table or a two dimensional array like structure in which each column contains values of one variable and each row contains one set of values from each column. Following are the characteristics of a data frame.

- The column names should be non-empty.
- The row names should be unique.
- The data stored in a data frame can be of numeric, factor or character type.
- Each column should contain same number of data Items.

Write a program in R to demonstrate the use of Data frame Objects

d. Matrices are the R objects in which the elements are arranged in a two dimensional rectangular layout. They contain elements of the same atomic types. Though we can create a matrix containing only characters or only logical values, they are not of much use. We use matrices containing numeric elements to be used in mathematical calculations

Write a program in R to demonstrate the use of Data frame Objects

1 Write a program in R which performs addition, subtraction, multiplication and division of two vectors.

2 Create a Comma Separated Values file consisting of the following details: Employee ID, Employee Name, Employee Phone Number, Address, Salary Display the input as Data Frames and also print the maximum salary within the input CSV.

3 Predictweightofapersonwiththeperson'sheightknownusingalinearregression.Uselm() to create a relationship model. Also, find the coefficients from the model created. Get a summary of the relationship model to obtain the average error in prediction.

4 Create a dataset "mtcars" available in the R environment. It gives a comparison between different car models in terms of mileage per gallon (mpg), cylinder, displacement ("disp"), horse power ("hp"), weight of the car("wt") and some more parameters. Create a regression equation to predict the mileage of a car given the disp, hp and wt.

5 Consider the annual rainfall details at a place starting from January 2012. Create an R time series object for a period of 12 months and plot it. Further, plot multiple time series within a single graph.

6 Use the R in-built data set named reading Skills to create a decision tree. It describes the score of someone's reading Skills if we know the variables "age", "shoe size", "score" and whether the person is a native speaker or not. Create a decision tree to show which age group and shoe size group is considered as a native speaker?

7 Use the same dataset reading Skills as above mentioned and identify what categorizes as a native speaker using Random Forests by creating 500 trees.

8 The iris dataset contains data about sepal length, sepal width, petal length, and petal width of flowers of different species. Knowing that there are a total of three species of flowers, perform K– Means clustering with value of "k" as 3 in order to create three clusters.

RECOMMENDED LEARNING RESOURCES:

1. John Maindonald, W. John Braun, "Data Analysis and Graphics Using R – an Example-Based Approach",3rd Edition,CambridgeUniversityPress,2010.(Chapters1.1-1.4,2.1-2.3,3.1-3.3,4.1 - 4.3, 5.1 - 5.4, 6.1 - 6.4)
2. Johannes Ledolter,"Data Mining And Business Analytics With R",WILEY,2013.(Chapters7,8 and15)

REFERENCES:

1. 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)
2. Roger D.Peng,"R Programming for Data Science",Leanpub,2015.
3. Springer, International Journal of Data Science and Analytics
4. Elsevier, Computational Statistics & Data Analysis
5. IEEE, Transactions on BigData.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8220	System Modeling and Simulation	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce mathematical foundations needed for simulation of real-world systems.
2. Provide an insight into how simulation modeling can aid in effective decision-making.
3. Design methodology for solving complex systems.
4. Understand the statistical modeling of real-world systems.
5. Develop new queuing analysis for both simple and complex systems.
6. Analyze the concept of planning and design in computer system.

COURSE OUTCOMES:

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

1. Make use of the simulation tools in real world applications.
2. Analyse the concept of scheduling with respect to time and events simulation analysis.
3. Develop an application program for generation of random numbers and random variants using different techniques.
4. Compare Verification and Validation of simulation models for given real world data.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit- I:

INTRODUCTION: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

GENERAL PRINCIPLES, SIMULATION SOFTWARE: Concepts in Discrete-Event Simulation: The Event- Scheduling / Time-Advance Algorithm.

Unit-II:

STATISTICAL MODELS IN SIMULATION: Review of terminology and concepts; Useful statistical models. QUEUING MODELS: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems.

RANDOM-NUMBER GENERATION - Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers.

Unit-III:

INPUT MODELING: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models

Unit-IV:

OUTPUT ANALYSIS FOR A SINGLE MODEL: Types of simulations with respect to output analysis; Stochastic nature of output data; Measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

VERIFICATION AND VALIDATION OF SIMULATION MODELS, OPTIMIZATION: Model building, verification and validation; Verification of simulation models; Calibration and validation of models. Optimization via Simulation.

RECOMMENDED LEARNING RESOURCES:

1. Discrete-Event System Simulation–Jerry Banks,John S.CarsonII,Barry L.Nelson,David M. Nicol, 4 th Edition, Pearson Education,2007.
2. Discrete–Event Simulation:A First Course–Lawrence M.Leemis,Stephen K.Park,Pearson Education/ Prentice-Hall India,2006.
3. Simulation – Sheldon M. Ross, 4th Edition, Elsevier,2006.
4. Simulation Modeling and Analysis –Averill M. Law, 4th Edition, Tata McGraw-Hill, 2007.
5. ACM Transactions on System Simulation.
6. IEEE Transactions on Modelling and Simulation

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./ Wk.
BTCS15F8230	Multimedia Systems	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce various multimedia components and software tools.
2. Explain different multimedia compression techniques.
3. Discuss the different image and video compression standards.
4. Outline different synchronization concepts and implementation.

COURSE OUTCOMES:

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

1. Apply different compression techniques depending on the multimedia object streams, interpret the various standards for multimedia communications and their features.
2. Demonstrate multimedia and its applications to potential clients.
3. Illustrate different Synchronization techniques used by Operating system for process management.
4. Apply Digitization and Quantization method in the real-time multimedia network applications.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction to Multimedia - What is Multimedia?, Multimedia: Past and Present, Multimedia Software Tools: A Quick Scan

Graphics and Image Data Representations - Graphics/Image Data Types, Popular File Formats, Color Models in Images

Unit-II:

Multimedia Data Compression - Lossless Compression Algorithms, Basics of Information Theory, Run- Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression.

Lossy Compression Algorithms - Introduction, Distortion Measures, The Rate-Distortion Theory, Quantization, Transform Coding.

Unit-III:

Image and Video Compressions - The JPEG Standard, The JPEG2000 Standard, The JPEG-LS Standard, Bi- level Image Compression Standards, Introduction to Video Compression, Video Compression Based on Motion Compensation, H.261, H.263, MPEG-1.

Unit-IV:

Synchronization - Defining "Synchronization", Particularities of Synchronization in Multimedia Systems, Requirements to the Presentation, Reference Elements for Synchronization, Synchronization Types, System Components Involved in Synchronization, A Reference Model for Multimedia Synchronization, Synchronization Specification, Specification Methods for Multimedia Synchronization.

RECOMMENDED LEARNING RESOURCES:

1. Li,Ze-Nian,Drew,MarkS.,Liu,Jiang chuan,"Fundamentals of Multimedia",Springer,2014.
2. Steinmetz,Ralf,Nahrstedt,Klara,"Multimedia Systems"Springer,2004

REFERENCES:

1. FredHalshall"Multimediacommunication-Applications,Networks,ProtocolsandStandards", Pearson education,2007.
2. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education.2008.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards,andNetworks",PearsonEducation2007.
4. Introduction to Multimedia Networks, Andrew W.Davis
5. Rao, Bojkovic, Milovanovic: Introduction to Multimedia Communications, Wiley & Sons, Hoboken, NJ,2006
6. IEEE, IEEE Transactions on Multimedia.
7. ACM, ACM Transactions on Multimedia Computing, Communications, and Applications
8. Elsevier, Elsevier Journal on Multimedia Computing.
9. Springer, Springer Journals on Communication Networks.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F8240	Software Defined Networks and Network Virtualization	16	SC	3	1	0	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the basic terminologies related to network virtualization.
2. Describe and distinguish the various Open Flow specifications.
3. Outline the technologies used in Data Centers.
4. Discuss various SDN Applications.
5. Compare and contrast different tools used in network virtualization.

COURSE OUTCOMES:

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

1. Enumerate and comprehend the fundamentals of Network virtualization.
2. Apply the SDN Use Cases in the Data Center.
3. Integrate SDN Network Virtualization.
4. Generalize Core networking functions in Virtualization.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit-I:

Introduction - Basic Packet-Switching Terminology, the Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Can We Increase the Packet-Forwarding IQ? Open Source and TechnologicalShifts.

Why SDN? Evolution of Switches and Control Planes, Cost, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs

The Genesis of SDN: The Evolution of Networking Technology, Forerunners of SDN, Software Defined Networking is Born, Sustaining SDN Interoperability, Open Source Contributions, Legacy Mechanisms Evolve Toward SDN, Network Virtualization.

Unit-II:

How SDN Works - Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods

The OpenFlow Specification - OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.1 Additions, OpenFlow 1.2 Additions, OpenFlow 1.3 Additions, OpenFlow Limitations. Alternative **Alternative Definitions of SDN -** Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization, Alternatives Overlap and Ranking

Unit-III:

SDN in the Data Center- Data Center Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations.

SDN in Other Environments - Consistent Policy Configuration, Global Network View, Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks

SDN Applications- Reactive versus Proactive Applications, Reactive SDN Applications, Proactive SDN Applications, Analyzing Simple SDN Applications, Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers.

Unit-IV:

SDN Futures - Potential Novel Applications of Open SDN, Applying Programming Techniques to Networks, Security Applications, Hiding IP Addresses, Segregating IPSec Traffic in Mobile Networks, Roaming in Mobile Networks, Traffic Engineering in Mobile Networks, Energy Savings, SDN-Enabled Switching Chips

Network Functions Virtualized-How Do You Virtualize a Network? Virtualizing Appliances Virtualizing Core Networking Functions, What About Scalability and Performance?

Modern Networking Approaches to Virtualization- From Consumers to Creators, OpenFlow, VMware Nicira, Cisco Insieme, OpenStack

RECOMMENDED LEARNING RESOURCES:

1. Paul Goransson, Chuck Black: Software Defined Networks A Comprehensive Approach ,1st edition, Elsevier,2014.

2. Jim Doherty, SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization, Pearson Education, Inc., March 2016

REFERENCES:

1. Thomas D.Nadea
2. u& Ken Gray: SDN Software Defined Networks O'Reilly publishers, First edition, 2013.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs./Wk.
BTCS15F8250	C# and .Net	16	SC	3	0	1	4	5

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the need of .NET platform and C#.
2. Introduce the basic features of C# and create a simple C# class.
3. Illustrate the OOPS concepts in C#.
4. Describe the concepts of Delegates and Interfaces

COURSE OUTCOMES:

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

1. Identify the basic components of the .NET Framework.
2. Develop a program using C# data types for real world applications.
3. Apply exception handling mechanisms of C# for real world applications.
4. Identify Industry defined problem and suggesting solutions using .NET application.

CO PO & PSO MAPPING:

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

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

COURSE CONTENTS:

Unit -I:

Introducing C# and .NET Platform : The Philosophy of .NET: Understanding the Previous State of Affairs, The.NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Roleof 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 Manifast, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime.

Unit- II:

C# Programming Language-I: The Anatomy of Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default assignment and Variable Scope, The C# Member Initialisation 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- III:

Object Oriented Programming with C#: Forms defining of the C# Class, Definition the "Default Public Interface" ofa 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, The Third Pillar: C#'s Polymorphic Support, Casting Between.

Exceptions 1: 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).

Unit -IV :

Exceptions 2: Custom Application-Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, Understanding object Lifetime, The Basics of Garbage Collection, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GCType.

Interfaces: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation. Understanding Callback Interfaces,

Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example.

RECOMMENDED LEARNING RESOURCES:

1. Andrew Troselen; Pro C# with .NET 3.0, Special Edition copyright2007.
2. E Balaguruswamy; Programming in C# , 5th reprint , Tata McGraw Hill2004.

REFERENCES:

1. K. Watson; C. Nagel; J. H Padderson; J.D. Reid; M. Skinner;*Beginning Visual C#;*Wiley2010.
2. Anne Boehm;Joel Murach;SPD Murach;*ASP.NET4 WebProgramming with C#*;4th Edition; 2010.
3. I. Spanjaars; *Beginning ASP.NET 4 in C# and VB*;2011.
4. J. Kanjilal; *ASP.NET 4.0 programming;* TataMc Graw-Hill.
5. D. Esposito; *Programming ASP.NET;* Microsoft Press (Dreamtech);2011.
6. Vijay Nicoel;*Visual C#.NET;* TMH
7. IEEE, IEEE Transactions Computers
8. ACM, ACM Transactions on Algorithms.

LAB EXPERIMENTS:

1. **Goals The programming interface goals of this lab are as follows:**
   - Introduce students to the Microsoft Visual Studio .NET programming environment
   - Introduce students to C# programming language
   - Enable students to compile and run their first C# program
   - Introduce students to online documentation and help.

2. **The programming abstraction goals of this lab are as follows:**
   - Introduce students to the concept of serial flow
   - Introduce students to the concept of variables
   - Introduce students to the concept of a loop.

3. **The programming application goal of this lab is to:**
   - Construct a simple C# windows application.
   - Allow students to use creativity in their programming

1. Simple Programs with C#:

a) Write a console application that obtains four int values from the user and displays the product. Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a double; the equivalent command to convert from a string to an int isConvert.ToInt32().

b) If you have two integers stored in variables var1 and var2; what Boolean test can you perform to see if one or the other (but not both) is greater than10?

c) Write an application that includes the logic from Exercise 1; obtains two numbers from the user; and displays them; but rejects any input where both numbers are greater than 10 and asks for two new numbers.

d) Write a console application that places double quotation marks around each word in a string

e) Write an application that uses two command-line arguments to place values into a string and an integer variable; respectively. Then display these values.

f) Write an application that receives the following information from a set of students:

Student Id:

Student Name:
Course Name:
Date of Birth:

The application should also display the information of all the students once the data is entered. Implement this using an Array of Structs.

g) Write programs using conditional statements and loops:

i. Generate Fibonacci series.

ii. Generate various patterns (triangles; diamond and other patterns) with numbers.

iii. Test for prime numbers.

iv. Generate prime numbers.

v. Reverse a number and find sum of digits of a number.

vi. Test for vowels.

vii. Use of foreach loop with arrays.

2. Object oriented programs with C#

a) Write a program to declare a class ' staff 'having data members as name and post. Accept this data 5 for 5 staffs and display names of staff who are HOD.

b) Write a program to declare class 'Distance' have data members dist1,dist2,dist3.Initialize the two data members using constructor and store their addition in third data member using function and display addition.

c) Write a program using function overloading to swap two integer numbers and swap two float numbers.

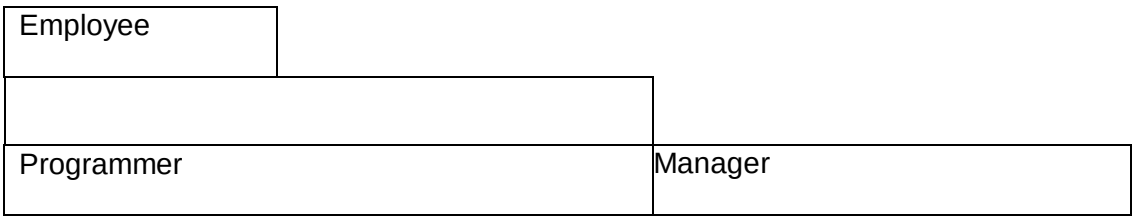
d) Write a program to implement single inheritance from following figure. Accept and display datafor one table.

Class Furniture Data Members : material ,price
Class Table Data Members : Height ,surface_area

e) Define a class 'salary' which will contain member variable Basic, TA, DA, HRA. Write a program using Constructor with default values for DA and HRA and calculate the salary of employee.

f) Write a program for above class hierarchy for the Employee where the base class is Employee and derived class and Programmer and Manager. Here make display function virtual which is common for all and which will display information of Programmer and Manager interactively.

g)



h) Write a program to accept a number from the user and throw an exception if the number is not an even number.

1. Programs using different controls
   a) Create an application that allows the user to enter a number in the textbox named 'getnum'. Check whether the number in the text box 'getnum' is palindrome or not. Print the message accordingly in the label control named lbl display when the user clicks on the button 'check'.
   b) Create an application which will ask the user to input his name and a message, display the two items concatenated in a label, and change the format of the label using radio buttons and check boxes for selection, the user can make the label text bold, underlined or italic and change its color. include buttons to display the message in the label, clear the text boxes and label and exit.
   c) List of employees is available in list box. Write an application to add selected or all records from list box (assume multi-line property of textbox is true).

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
BTCS15F8300	**Project Work Phase-2**	16	HC	0	2	8	10	20

COURSE OBJECTIVE:

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them todeliver 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:

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

CO PO & PSO MAPPING:

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.

Summer 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:

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 OUTCOME:

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

CO PO & PSO MAPPING:

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 competion results(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 requirement. 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 andstudents 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:

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:

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

CO PO & PSO MAPPING:

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 choose two Global certification among the available Industry ready courses to cope up with
- the vast changing software world.
- Student should register the course minimum 50 hours each and must attend 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.

TRAINING AND PLACEMENT

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

- Willingness tolearn
- Self-motivation
- Teamwork
- Communication skills and application of these skills to real scenarios
- Requirement of gathering, design and analysis, development and testing skills
- Analytical and Technical skills
- Computer skills
- Internet searching skills
- Information consolidation and presentation skills
- Roleplay
- Group discussion, and soon

The REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling, Training and Placement (CCTP) Centre headed by well experienced dynamic Trainer, Counselor and Placement Officer supported by an efficient team does handle all aspects of Internships and Placement for the students of REVA University. The prime objective of the CCTP Centre is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CCTP Centre organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CCTP Centre forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Engineering is efficient leaders of repute, who can deal the real time problems with a flavor of innovation. This kept in focus, the Training and Placement cell has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, leadership, and strategic management and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his/her interest and march forward to make better career.

Skill development is one of the very important activities of the University and Industry relationship.

A skill development centre is established to organize skill and certification programs. The students shall compulsorily complete atleast two skill/certification based programs before the completion of the degree.

The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs.

The various skill/certification programs identified are as follows.

- Big-data and Cloud Computing, Internet of Things (IOT), ORACLE, MYSQL, Advanced Java and Internals of LINUX/UNIX
- Red-hat certified programs on LINUX,
- Management related programs like SAP,ERP and Business Analytics

- Open Source software/hardware, Software Testing
- Advanced networking based CISCO / Microsoft technology.
- Web designing, System administration
- IBM certified programs.

The University has signed MOU's with Multi-National Companies, research institutions, Government agencies like NSDC (National Skill Development Corporation) and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.