REVA UNIVERSITY

Bengaluru, India

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

B. TECH – COMPUTER SCIENCE & ENGINEERING

2018-2022

Rukmini Educational Charitable Trust

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

HANDBOOK

B. Tech. in Computer Science & Engineering

2018-22

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

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

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

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

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

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

Welcome to the portals of REVA University!

Dr. 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, Lot 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 and global developmental needs. Maximum number of courses are integrated with cross cutting issues with relavant to professional ethics Gender human values environment and sustainability.

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 Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

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

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 15,000+ students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conductive 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 Intelligance, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, , LED Lighting, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management,

Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

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

Skill Development Training programs, Entrepreneurship activities, and IPR workshops. UIIC has established REVA NEST, an incubation center for promoting start up industries.

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

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

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is **'Life Time Achievement Award'** to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the **"Founders' Day Celebration"** of REVA University on 6th January of every year in presence of dignitaries, faculty members and students gathering. The first "**REVA Life Time Achievement Award**" for the year 2015 has been awarded to Shri. Kiran Kumar,

Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence"** in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

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

Within short span of time, REVA University has been 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, 6^{TH} Rank in the Super Excellence category by GHRDC, 6^{TH} 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.

The curriculum caters to and has relevance to local, regional, national, global developmental needs. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

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. Three postgraduate programs offered in the school are: M Tech in Data Engineering and Cloud Computing and M Tech in Computer Science and Engineering (Both Full time and Part time). 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 technologists and researchers in computer science and information technology who have potential to contribute to the development of the nation and the society with their expertise, skills, innovative problem-solving abilities and strong ethical values.

Mission

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

MD2: Provide quality education in both theoretical and applied foundations of computer science and related inter-disciplinary areas and to train students to effectively apply the education to solve real-world problems.

MD3: Amplify student's 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.

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

MD5: 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
6	Dr. Heggere S. Ranganath, Professor and Chair, Computer Science Department University of Alabama in Huntsville Huntsville, USA
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 MallikarjunaShastry P M**, Professor School of C & IT, REVA University	Member
3	**Dr Kiran Kumari Patil**, Director UIIC REVA University	Member
4	**Dr Mallikarjuna M Kodabagi**, Professor and Deputy Director IQAC, REVA University	Member
5	**Prof Ashwin Kumar U M**, Associate Professor, School of C & IT, REVA University	Member
6	**Dr Gopala Krishna Shyam**, Associate Professor, School of C & IT, REVA University	Member
7	**Mr. Chetan Shivakumar**, CEO & Cofounder, Aikaan Labs Pvt Ltd, Bengaluru.	Member
8	**Mr. Muralidhar Jahagirdhar**, Practice Head Engineering, ATMECS Technology Pvt Ltd, Hyderabad	Member
9	**Mr. Ravikant Soni**, Technical Manager, Solution Architect, Standard Chartered bank, Bengaluru.	Member
10	**Dr Sanjay**, HoD Dept. of ISE, NITTE Meenakshi Institute of Technology, Bengaluru	Member
11	**Dr Raghavendra Kulkarni**, Director of Academics, M. S. Ramaiah University of Applied Sciences, Bengaluru	Member

B Tech (Computer Science & Engineering) Program

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

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

The career opportunities for computer science and engineering graduates are plenty and growing. Programming and software development, information systems operation and management, telecommunications and networking, computerscience 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.

The curriculum caters to and has relevance to local, regional, national, global developmental needs. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

The Program Educational Objectives (PEOs):

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:

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

PO-2: Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

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.

Programme Regulations

Students will be provided with programme regulations which deals about credit structure, teaching and Learning processes, Assessment, Re-examination, Degree awarding requirements

REVA UNIVERSITY
Bengaluru, India

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Four Year Graduate Degree Programs - 2018

1. **Teaching and LearningProcess**:

   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 courses 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 **Courses of Study** are labeled and defined as follows:

a. Core Course:

A course which should compulsorily be studied by a can did at easacore-requirementistermed asaCorecourse.TheCORECoursesofStudyareofTHREEtypes, 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 them a indiscipline the student is studying is called an **Open ElectiveCourse.**

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 HardCore.

Scheme, Duration and Medium of Instructions:

- B Tech degree program is of 8 semesters 4 years duration. A candidate can avail a maximum of 16 semesters- 8 years 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.
- The medium of instruction shall be English.

4. Minimum Credits to be Earned

- A candidate has to earn 192 credits for successful completion of B Tech degreewith 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. 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.
- 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 shallbe 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.

4.1 Add- on Proficiency Certification:

To acquire **Add on Proficiency Certification** a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 192 credits for the B Tech Degree program.

4.2 Add on Proficiency Diploma:

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

The Add 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;

Internal Assessment (IA); and

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 = 30 marks

Assignments / Seminars / Model Making etc. = 10 marks

6. Assessment of Performance in Practicals

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

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

6.2 The 40 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall furthe be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
Iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test include performance in the conduction of experiment and write up about the experiment.	10 marks
	Total	**40 marks**

63. The 60 marks meant for 6.3 Smester End 6.3

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

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	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, and 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 a stipulated period.

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

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 in 10.3.

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 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).

11.5. Absence during Internal Test:

In case a student has been absent from an internal test due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher/authorized personnel to the concerned 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 GradePoint

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 ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	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

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 ith 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.

12.4.2 Illustration: 4

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=24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25=8.10196

12.4.3 CONVERSION OF GRADES INTO PERCENTAGE:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

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 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.**

a. 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.

b. 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 2018-22

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% incase 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% incase of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. **(C)** Provided that incase of students belonging to B.Sc. Stream, shall clear the subjects of Engineering Graphics/ Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second 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 Diplomastream. **(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 a smentioned in A, B, D, and E above.
3	Bachelor of Technology (BTech)	Lateral entry to fourth year (final year)	**(F)** Provided further that Students who completed successfully 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 later all admission to the respective semester in the concerned branch of study.

1. Evaluation of Major/Minor Project

Sl.No	Examination	Max. Marks	Requirements/Documents to Be Submitted	Tentative Schedule
1	IA1	25	1.Synopsis Report 2.Weekly progress Reports 3.Presentation	6 weeks from semester start date
2	IA2	25	1.MID-TERM report 2.Weekly progress Reports 3.Presenation	6 weeks from IA1
3	IA3	20 marks for Viva 30 marks for Thesis Evaluation Total 50	1.Thesis Report 2. Weekly progress Reports. 3.Final Presentation	Two weeks from IA2

2. Evaluation of Internship

Sl.No.	EXAM	MAX.MARKS	Documents To Be Submitted	Tentative Scheduling
1	IA1	25	1.Synopsis Report/PHASE-1 2.Presenation	6 weeks from semester start date
2	IA2	25	1.MID-TERM report/ PHASE-2 2.Presenation	6 weeks from IA1
3	IA3	20 marks for Viva 30 marks for Thesis Total 50	1. Internship Final Report 2. Final Presentation	Two weeks from IA2

3. Evaluation of Global Certification Program

Sl.No	EXAM	MAX.MARKS	Documents To Be Submitted	Tentative Scheduling
1	IA1	25	1. PHASE-1 Report on their topic of Certification. 2. Presentation.	6 weeks from semester start date
2	IA2	25	1. MID-TERM report/ PHASE-2 on Their Topic of Certification. 2.Presenation	6 weeks from IA1
3	IA3/SEE	20 marks for Viva 30 marks for Thesis Total 50	1. Final Report 2. Final Presentation 3. Global Certificate.	Two weeks from IA2

REVA UNIVERSITY
Bengaluru, India

School of Computing and Information Technology

B. Tech. in Computer Science and Engineering

Scheme 2018-2022

Scheme of Instruction

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Value					Weekly Contact Hours	Teaching School/ Dept.
				L	T	P	J	C		
First Semester:										
1	B18CS1010	Multivariable Calculus and Linear Algebra	HC	4	0	0	0	4	4	CIT/Mat
2	B18CS1020	Chemistry	HC	3	0	0	0	3	3	Chemistry
3	B18CS1030	Programming for Problem Solving	HC	3	0	1	0	4	5	CIT
4	B18CS1040	Basic Electrical and Electronics Engineering	HC	4	0	0	0	4	4	EE
5	B18CS1050	EnvironmentalScience	HC	2	0	0	0	2	2	Chemistry
6	B18CS1060	TechnicalEnglish-1	FC	0	0	2	0	2	4	Arts and Humanities
7	B18CS1070	Basic Electrical and Electronics Engineering Lab	HC	0	0	2	0	2	2	EEE
8	B18CS1080	Chemistry Lab	HC	0	0	2	0	2	2	Chemistry
9	B18CS1090	Skill Development-1	HC	0	0	0	0	1	2	UIIC/CIT
Total								**24**	**29**	

Note: Workshop tour to be conducted to introduce Mechanical Tools (One Day). Building construction tour to be conducted to introduce construction fundamentals and technologies (One day). Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru.

Second Semester:

1	B18CS2010	Probability and Statistics	HC	4	0	0	0	4	4	CIT/Mat
2	B18CS2020	Physics	HC	3	0	0	0	3	3	Physics
3	B18CS2030	ObjectOriented Programming	HC	3	0	0	0	3	3	CIT
4	B18CS2040	Technical English-2	FC	0	0	2	0	2	4	Arts & Humanities
5	B18CS2050	Indian Constitution and Professional Ethics	FC	2	0	0	0	2	2	Law
6	B18CS2060	Computer Aided Engineering Drawing Lab	HC	0	0	2	0	2	4	ME
7	B18CS2070	Object Oriented Programming Lab	HC	0	0	2	0	2	2	CIT
8	B18CS2080	Physics Lab	HC	0	0	2	0	2	2	Physics
9	B18CS2X10	Skill Development-2	HC	0	0	0	0	1	2	UIIC/CIT
10	B18CS2X20	Sports/Yoga/Music/Dance/Theatre	RULO	0	0	2	0	2	2	Others
Total								**23**	**28**	

Note: Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru. All students must participate in a mini project exhibition and Hackathon.

Third Semester :

1	B18CS3010	Digital Logic Design	HC	3	0	0	0	3	3	CIT
2	B18CS3020	Analog Electronic Circuits	HC	3	0	0	0	3	3	CIT/ECE
3	B18CS3030	Programming with Java	HC	3	0	1	0	4	4	CIT
4	B18CS3040	Data Structures	HC	3	0	0	0	3	3	CIT
5	B18CS3050	Discrete Mathematics	HC	3	0	0	0	3	3	CIT/Mat
6	B18CS3060	Software Engineering	HC	3	0	0	0	3	3	CIT
7	B18CS3070	Data Structures Lab	HC	0	0	2	0	2	2	CIT

8	B18CS3080	Logic Design anAnalog Circuits Lab	HC	0	0	2	0	2	2	CIT
9	B18CS3090	Skill Development-3	HC	0	0	0	1	1	2	UIIC/CIT
10	B18CS3X10	Soft Skills-1	HC	0	0	2	0	2	2	Placement
Total								**26**	**27**	
Note: Awareness workshop on free and open source tools and commercial tools for computer science and engineering application development has to be conducted. Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru.										
Fourth semester:										
1	B18CS4010	Design and Analysis of Algorithms	HC	3	0	1	0	4	5	CIT/Mat
2	B18CS4020	Graph Theory	HC	3	0	0	0	3	3	CIT/Mat
3	B18CS4030	Database Management System	HC	3	0	0	0	3	3	CIT
4	B18CS4040	Computer Organization and Architecture	HC	3	0	0	0	3	3	CIT
5	B18CS4051/5	Softcore -1 (SC-1)	SC	-	-	-	-	3	3	CIT
6	B18CS4060	Database Management System Lab	HC	0	0	2	0	2	2	CIT
7	B18CS4070	ARM Microcontroller and IoT Lab	HC	0	0	2	0	2	2	CIT
8	B18CS4080	Skill Development-4	HC	0	0	0	1	1	2	UIIC/CIT
9	B18CS4090	Soft Skills-2	HC	0	0	2	0	2	2	Placement
Total								23	25	
Note: All students must participate in a miniproject exhibition and Hackathon. Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru.										
Fifth Semester :										
1	B18CS5010	Finite Automata and Formal Languages	HC	3	0	0	0	3	3	CIT
2	B18CS5020	Python for Data Analysis	HC	2	0	1	0	3	3	CIT
3	B18CS5030	Computer Networks	HC	3	0	0	0	3	3	CIT

Total Credits = 192

4	B18CS5040	Operating Systems	HC	3	0	1	0	4	5	CIT
5	B18CS5051/5	Softcore - 2 (SC-2)	SC	-	-	-	-	3	3	CIT
6	B18CS5061/5	Softcore - 3 (SC-3)	SC	-	-	-	-	3	3	CIT
7	B18CS5070	Statistical Data Analysis Lab	HC	0	0	2	0	2	2	CIT
8	B18CS5080	Computer Networks lab	HC	0	0	2	0	2	2	CIT
9	B18CS5090	Skill Development -5	HC	0	0	0	1	1	2	UIIC/CIT
10	B18CS5X10	Soft Skills-3	HC	0	0	2	0	2	2	Placement
Total								26	28	
Note: Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru.										
Sixth Semester :										
1	B18CS6010	Machine Learning for Data Analytics	HC	3	0	1	0	4	5	CIT
2	B18CS6020	Cloud Computing and Big Data	HC	3	0	0	0	3	3	CIT
3	B18CS6031/5	Softcore - 4 (SC-4)	SC	-	-	-	-	3	3	CIT
4	B18CS6041/5	Softcore -5 (SC-5)	SC	-	-	-	-	3	3	CIT
5	B18CS6051/4	Softcore - 6 (SC-6)	SC	-	-	-	-	3	3	CIT
6	B18CS6061/4	Softcore-7 (SC-7)	SC	-	-	-	-	3	3	CIT
7	B18CS6070	Cloud Computing Lab	HC	0	0	2	0	2	2	CIT
8	B18CS6080	Skill Development-6	HC	0	0	0	1	1	2	UIIC/CIT
9	B18CS6090	Soft Skills-4	HC	0	0	2	0	2	2	Placement
Total								24	26	
Note: All students must participate in a miniproject exhibition and Hackhathon. Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru.										

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Value					Weekly Contact Hours	Teaching Dept.
				L	T	P	J	C		
Seventh Semester										
1	B18CS7010	Web Application Development	HC	3	0	1	0	4	5	CIT
2	B18CS7020	Cryptography and Network Security	HC	3	0	0	0	3	3	CIT
3	B18CS7031	Internet Computing & Applications	OE	3	1	-	-	4	4	CIT
4	B18CS7032	Data Structures	OE							
5	B18CS7041/4 / B18CS7081	Softcore - 8 (SC-8) / Internship	SC	3	-	-	-	3	3	CIT
6	B18CS7051/4	Softcore - 9 (SC-9)	SC	3	-	-	-	3	3	CIT
7	B18CS7061/4 /	Softcore - 10 (SC-10)	SC	3	-	-	-	3	3	CIT
8	B18CS7071/4 / B18CS7081	Softcore - 11 (SC-11) / Internship	SC	3	-	-	-	3	3	CIT
9	B18CS7080	Project Work and Dissertation Phase 1	HC				1	1	2	CIT
10	B18CS7081	Internship	SC					6		CIT
Total								**24**	**26**	

Note:

1. **The project work phase-1** of project dissertation of 8th semester will begin in 7th semester, where student has to form a project group and perform literature survey and define the problem tools and technologies to be used. Options for 8th semester must be selected in 7th semester.

2. The students under **internship** with 6 credits shall have only two softcore courses SC 9 and SC 10 along with internship

3. **Open Electives,** namely '**Internet Computing & Applications'** and '**Data Structures'** are offered for students belonging to Schools other than Computing and Information Technology. The students of B.Tech in Computer Science and Engineering shall have to choose one of the **Open Electives** offered by any other School.

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Value					Weekly Contact Hours	Teaching Dept.
				L	T	P	J	C		
	Eighth Semester									
1	B18CS8010	Internship/Skill Development / Global Certification Program	HC	-	-	-	-	6	6	CIT/others
2	B18CS8020	MOOC	HC	-	-	-	-	4	4	Others
3	B18CS8031/5	Softcore-12 (SC-12)	SC	3				3	3	CIT
4	B18CS8040	Project Work and Dissertation Phase-2	HC	-	-	-	9	9	9	CIT
Total								**22**	**22**	
Total Credits for all Eight Semesters:								**192**		

Note: Internship must be for atleast 2 months to be considered for 6 credits. Internships abroad must be for atleast 3 to 4 weeks to be considered for the credits. Global certification program students must obtain a certificate to attain 85 to 100% marks based on relative performance. If not eligible for certificate, they will have to undergo examination at school level for 80% marks, and marks will be awarded based on examination performance. Such a program will be considered as Skill Development Program.

Code for the representation of the Soft core /Specialization Groups

A: Data Engineering,

B: System Design & Computing,

C: Robotics,

D: Communication/Networking

E: Software Systems,

F: Others

Sl.No.	Course Code	Name of the Course	L	T	P	J	C	Specialization Group
		Semester – IV (SC-1)						
1	B18CS4051	Signal sand Systems	2	1	0	0	3	F

2	B18CS4052	System Software	3	0	0	0	3	F
3	B18CS4053	Embedded System Design	2	1	0	0	3	B
4	B18CS4054	Operation Research	2	1	0	0	3	B
5	B18CS4055	Numerical Techniques	2	1	0	0	3	B
		Semester – V (SC-2)						
1	B18CS5051	Object Oriented Analysis and Design	3	0	0	0	3	B
2	B18CS5052	IoT Programming and Applications	2	0	0	1	3	B
3	B18CS5053	Software Testing	2	0	1	0	3	E
4	B18CS5054	Digital Communication	3	0	0	0	3	D
5	B18CS5055	Microprocessors and Interfacing	3	0	0	0	3	F
		(SC-3)						
1	B18CS5061	Unix System Programming	2	0	1	0	3	E
2	B18CS5062	Advanced DBMS	2	0	0	1	3	A
3	B18CS5063	Introduction to Robotics	3	0	0	0	3	C
4	B18CS5064	High Performance Computing	3	0	0	0	3	B
5	B18CS5065	Differential and Difference equations	3	0	0	0	3	F
		Semester – VI (SC-4)						
1	B18CS6031	Signal Processing with SCIILAB	2	0	1	0	3	B
2	B18CS6032	Principles of Programming languages	3	0	0	0	3	A
3	B18CS6033	Compiler Design	3	0	0	0	3	B
4	B18CS6034	Artificial Intelligence	3	0	0	0	3	B
5	B18CS6035	Computer Design with Verilog	3	0	0	0	3	B
		(SC-5)						
1	B18CS6041	Digital Image Processing	3	0	0	0	3	C
2	B18CS6042	Advanced Java Programming	2	0	0	1	3	A
3	B18CS6043	Data Mining and Warehousing	2	0	1	0	3	B
4	B18CS6044	System Modeling and Simulation	3	0	0	0	3	D
5	B18CS6045	Research Methodology	4	0	0	4	4	F
		(SC-6)						
1	B18CS6051	Pattern Recognition	2	0	1	0	3	A
2	B18CS6052	Text & Web Mining	2	0	1	0	3	A
3	B18CS6053	Wireless and Mobile Networks	3	0	0	0	3	D
4	B18CS6054	Parallel Processing and Algorithms	2	0	1	0	3	D
		(SC-7)						
1	B18CS6061	Mobile Application Development	2	0	0	1	3	E
2	B18CS6062	Advanced Computer Networks	3	0	0	0	3	D

3	B18CS6063	Introduction to Genomic Sciences	3	0	0	0	3	F
4	B18CS6064	UI/UX Design	2	0	0	1	3	B
		Semester – VII (SC-8)						
1	B18CS7041	Augmented and virtual Reality	3	0	0	0	3	A
2	B18CS7042	Network Programming	2	0	0	1	3	D
3	B18CS7043	C# and. Net	2	0	1	0	3	E
4	B18CS7044	Natural Language Processing	3	0	0	0	3	A
		(SC-9)						
1	B18CS7051	Data Science using R	2	0	0	1	3	E
2	B18CS7052	Deep Learning	2	0	1	0	3	B
3	B18CS7053	Multimedia Computing and Networks	3	0	0	0	3	D
4	B18CS7054	Business Intelligence and Process Management	3	0	0	0	3	B
		(SC-10)						
1	B18CS7061	Human Computer Interaction	3	0	0	0	3	B
2	B18CS7062	Computer Graphics and Animation	2	0	1	0	3	E
3	B18CS7063	Software Defined Networks and Network Function Virtualization	3	0	0	0	3	D
4	B18CS7064	Advanced Web Technology	2	0	0	1	3	F
		(SC-11)						
1	B18CS7071	Big Data Analytics	2	0	1	0	3	A
2	B18CS7072	Block Chain Technology	3	0	0	0	3	A
3	B18CS7073	Cloud Security	3	0	0	0	3	A
4	B18CS7074	Bio-informatics	2	0	0	1	3	B
		Semester VIII (SC-12)						
1	B18CS8031	Real Time Systems	3	0	0	0	3	A
2	B18CS8032	Innovation and Entrepreneurship Present	2	0	1	0	3	B
3	B18CS8033	Ethical Hacking and IT Security Evaluation	3	0	0	0	3	F
4	B18CS8034	Cognitive Science and Computing	3	0	1	0	3	F
5	B18CS8035	Data Compression						E

List of some Global Certifications:

1. CISCO: CCNA (Network Associate), CCNP (Network Professional – Routing and Switching), CCNA (NA with Security Credential)

2. MICROSOFT: MCSD (Solutions developer for web applications), MCSA (Solutions associate windows server), MCSE (Systems engineer), Data Science
3. IEEE: SDA (Software development associate)
4. Comptia: Security+, A+, Linux+
5. Citrix certified professional Virtualization CCP-V, by CITRIX
6. Risk and information systems control (CRISC), by ISACA
7. Scrum master by Scrum Alliance
8. Information Security Manager by ISACA
9. Project management professional by PMI
10. Citrix certified associate Networking (CCA-N)
11. Certified ethical hacker by EC council
12. Certified information systems security professional CISSP by ISC
13. Certified information systems auditor CISA, by ISACA
14. AWS certified solutions architect associate
15. Google certified professional
16. Google ad words professional
17. Google cloud professional
18. IBM Certification (developer, administrator, database)
19. Oracle certification
20. Dell EMC certification (storage, networking, server)
21. HP certification
22. Intel certification
23. Mcafee certification
24. VMWARE certification

List of some MOOC Centers:

1. Swayam
2. NPTEL
3. Coursera
4. Edx
5. Khan academy

6. Udacity
7. Udemy
8. Stanford online
9. WizIq

Guidelines 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/Minor Project

Sl.No	Examination	Max. Marks	Requirements/Documents To Be Submitted	Tentative Schedule
1	IA1	25	1.Synopsis Report 2.Weekly progress Reports 3.Presentation	6 weeks from semester start date
2	IA2	25	1.MID-TERM report 2.Weekly progress Reports	6 weeks from IA1

			3.Presentation	
3	IA3	20 marks for Viva 30 marks for Thesis Evaluation Total 50	1.Thesis Report 2. Weekly progress Reports. 3.Final Presentation	Two weeks from IA2

2. Evaluation of Internship

Sl.No.	EXAM	MAX.MARKS	Documents To Be Submitted	Tentative Scheduling
1	IA1	25	1. Synopsis Report/PHASE-1 2. Presenation	6 weeks from semester start date
2	IA2	25	1. MID-TERM report/ PHASE-2 2. Presentation	6 weeks from IA1
3	IA3	20 marks for Viva 30 marks for Thesis Total 50	1. Internship Final Report 2. Final Presentation	Two weeks from IA2

3. Evaluation of Global Certification Program

Sl.No	EXAM	MAX.MARKS	Documents To Be Submitted	Tentative Scheduling
1	IA1	25	1. PHASE-1 Report on their topic of Certification. 2. Presentation.	6 weeks from semester start date
2	IA2	25	1. MID-TERM report/ PHASE-2 on Their Topic of Certification. 2. Presenation	6 weeks from IA1
3	IA3/SEE	20 marks for Viva 30 marks for Thesis Total 50	1. Final Report 2. Final Presentation 3. Global Certificate.	Two weeks from IA2

B Tech (Computer Science and Engineering)

Detailed Syllabus

I Semester

B18CS1010	Multi variable Calculus and Linear Algebra	L	T	P	C
Duration:14 Wks		4	0	0	4

Prerequisites:

Knowledge of limits, continuity, differentiation, integration, matrices, determinants, and geometry.

Course Description:

This course covers basic concepts of calculus and linear algebra particularly in power series expansion of functions, techniques to solve undefined forms, angle between the polar curves, solving system of equations and to find the inverse of matrix.

Course Objectives:

Objectives of this course are to:

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

Course Outcomes (Cos):

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

CO1: Apply Taylor's and Maclaurin's series for finding series expansions of functions and approximating values.

CO2: Identify and evaluate the radius of curvature of the given curve. Also evaluate the given in determinate form using L' Hospital rule.

CO3: Make use of Gauss elimination and Gauss Jordon method for solving the system of equations, if the given system of equations is consistent.

CO4: Determine the Eigen values, the corresponding Eigen vectors and diagonalize the given square matrix.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO 4	2	3	2	-	-	-	-	-	-	-	-	-	3	-	-

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

Course Contents:

UNIT- 1

Introduction to Vector Calculus: Definition and types of vectors, algebra of vectors, scalar (or dot) product of two vectors, scalar product of three vectors and vector product of three vectors.

Differential Calculus-1: Successive differentiation- nth derivatives of standard functions (no proof) simple problems, Leibnitz Theorem (without proof) and problems, Taylors series and McLaurin's series expansion for function of one variable (only problems), Polar curves- Angle between the radius vector and the tangent, angle between two curves, Pedal equation for polar curves. Applications in computer science.

UNIT -2

Differential Calculus-2: Derivative of arc length – concept and formulae (without proof), Radius of curvature-Cartesian, parametric, polar and pedal forms (with proof) problems.

Indeterminate forms and solution using L'Hospital's rule. Analysis of Randomized algorithms using Differential Calculus. Applications in computer science.

UNIT- 3

LinearAlgebra-1: Basic concepts, Echelon form, normal form of a matrix, Rank of Matrix, Gauss-Jordon method to find inverse of a matrix, consistency of linear system of equations, Gauss elimination and Gauss-Jordon method to solve system of equations. Linear Algebra for statistics. Applications in computer science.

UNIT- 4

Linear Algebra-2: Linear Transformations, orthogonal transformation, Eigen values and Eigen Vectors. Complex matrices, Similarity of Matrices, Diagonalization. Rayleigh power method to determiner largest Eigen value and the corresponding Eigen vector. Analysis of Randomized algorithms using Linear Algebra. Applications in computer science.

Self-Learning Components:

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

TEXT BOOKS:

1. Theodore Shifrin, "Multi-Variable Calculus and Linear Algebra with Applications", Wiley, 1st Edition, Volume 2, 2018.

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

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

4. Ron Larson, "Multivariable Calculus, Cengage Learning", 10th Edition, 2013.

REFERENCE BOOKS:

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

2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2016.

3. Stanley I. Grossman, "Multivariable Calculus, Linear Algebra, and Differential Equations", 2nd Edition, Academic Press 1986.

B18CS1020	Chemistry	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Chemistry in Intermediate.

Course Description

This course provides the fundamental knowledge of basic principles of Engineering chemistry which is required for basic foundation in Engineering Education irrespective of branch. The course also provides the introduction to the electro chemistry concepts like Cell reactions, Fuel cells and its applications, Battery technology, Polymer materials and Nano-materials.

Course Objectives:

The objectives of this course are to:

1. Explain the basic concepts of Atomic and Molecular Structure, energy level diagram and quantum chemistry
2. Design construction and applications of Batteries, fuel cells and solar cells
3. Classify the types of Corrosion, corrosion control and metal finishing techniques
4. Discuss the use of engineering materials like Nano, Polymers Semiconductors, superconductors, magnetic materials, liquid crystals in various applications

Course Outcomes:

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

CO1: Analyze the basic concepts of Atomic and Molecular structure, energy level diagrams and quantum mechanics

CO2: Outline the construction and working of batteries fuel cells and solar cells

CO3: Apply the knowledge of corrosion science and metal finishing essential for corrosion control of commercially available materials like PCB and circuits

CO4: Identify the applications of engineering materials in various fields.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	2	1	2	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	2	3	3	-	-	-	-	-	-	-	-	-	1	-	-

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

Course Content:

UNIT-1:

Electrons in Atomic, Molecular Structure and Periodicity:

Electrons in Atomic, molecular structure: Classical to quantum mechanical transition, Origin of quantum mechanics, dual nature of light and matter, concept of quantization – Max Planck, Einstein, de Broglie, Schrödinger wave equation, particle in a box (1D)-Energy solutions, wave nature and quantum states of electron, orbital wave functions in bond formation (H2)

Periodic Properties: Effective nuclear charge, penetration of orbital, atomic and ionic sizes, ionization energies, electron affinity and electro negativity.

UNIT-2:

Energy Storage and Conversion Devices:

Battery: Introduction to electrochemistry, Basic concepts of Cells and Battery, Battery characteristics –primary (Leclanche Cell), secondary (Lead-Acid), Lithium batteries, Advantage of use of Li as electrode material (Lithium & Lithium ion), Electrochemical Capacitor.

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: Band structure of solids and the role of doping on band structures. Properties of Silicon, advantages, P-N Junction diode, antireflective coatings. Construction, working of photovoltaic cells, applications, advantages and disadvantages

UNIT-3:

Science of Corrosion and its Control:

Corrosion: Electrochemical theory of corrosion, Types of Corrosion- Differential metal corrosion, Differential aeration corrosion (Pitting & water line),

Boiler corrosion, and Grain boundary corrosion, Factors affecting rate of corrosion-Primary, secondary. Corrosion control: Galvanizing & tinning, cathodic protection & Anodic Protection. Metal Finishing: Theory of electroplating. Effect of plating variables on the nature of electro deposit- electroplating process, Electroplating of gold. Electro less plating of Copper and PCB.

UNIT 4:

Chemistry of Engineering Materials:

Semiconducting and Super Conducting materials: Principle and some example. Magnetic material: Principle and types of magnetic materials-applications of magnetic materials in storage devices. Polymers-Introduction, Polymer composites (carbon fibre and Kevlar, synthesis, advantages, applications).Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline. Liquid Crystals: Introduction, classification and applications.

Nanomaterials-Introduction – Definition, classification based on dimensionality (1D, 2D and 3D), quantum confinement (electron confinement). Size dependent properties- surface area, magnetic properties (GMR phenomenon) and thermal properties (melting point). Properties of Carbon Nanomaterials (mention of -Fullerenes, Graphene, Carbon nanotubes).

Self-learning component:

Molecular orbitals of diatomic molecules. Alkaline Fuel Cell, Introduction to Electromagnetic spectrum, Czocharlski method, Pourbaix diagram (Al, Fe). Inorganic Coatings and aromaticity, Crystal field theory and transition metal ions and their magnetic properties, HSAB Concepts, molecular geometries Inhibitors, Types of polymerization, Applications of nano materials- in various fields, Glass transition temperature (tg) - definition, significance. Structure and Property relationship – tensile strength and plastic and elastic deformation.

TEXTBOOKS:

1. SS Dhara, "A Text book of Engineering Chemistry", S. Chand Publications, New Delhi, 12th Edition, 2014.

2. Shashichawla, "Text Book of Engineering Chemistry", Dhanapath Rai & Co Publications, Reprint Edition 2013.

3. P.W. Atkins, "Physical Chemistry", Oxford university press, 11thEdition, 2017.

4. Shikha Agarwal, "EngineeringChemistry: Fundamentals and Applications", Cambridge University Press, 2016

5. M.G. Fontana., "Corrosion Engineering", Tata McGraw Hill, 3rd Edition, 2017.

REFERENCE BOOKS:

1. V.R. Gowrikar, N.N. Vishwanathan and J. Sreedhar, "Polymerchemistry", Wiley eastern ltd, 1993.
2. Charles P. Poole Jr., Frank J. Owens, "Introduction to Nanotechnology, Wiley India Publishers, 2004.
3. Krishan K Chawla," Composite materials: Science and Engineering", Springer International edition, 2nd edition, 1985.

B18CS1030	Programming for Problem Solving	L	T	P	C
Duration:14 Wks		3	0	0	3

Course Description:

The objectives of this course is to make students learn basic principles of problem solving, present the syntax and semantics of the "C" language, implement through C language using constructs offered by the language.

Prerequisites:

The fundamental concepts in computer algorithms and programming

Course Objectives:

Objectives of this course are to:

1. Explain the different programming constructs of C to be used for a given application.
2. Illustrate the Usage of iterative statements, conditional Statements for solving the real-world problems.
3. Demonstrate the use parameter passing mechanism for solving the real-world problems.
4. Illustrate the use of structures and unions for solving the real-world problems.

Course Outcomes (CO's):

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

CO1 : Identify the programming constructs of C language to solve a given problem.

CO2 : Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.

CO3 : Develop text processing-based applications using pointers, strings and functions.

CO4 : Create solutions for real world problems using Union, Structures and file operations.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	1	3	1	2	1	-	1	3	3	-	1	3	3	3
CO 2	1	3	2	2	1	-	-	1	3	3	-	1	3	3	3
CO 3	2	2	2	2	1	-	-	1	3	3	-	1	3	3	3
CO 4	3	3	3	1	1	-	-	1	3	3	-	1	3	3	3

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

Course Contents:

Unit -1:

Introduction: Introduction to Linux and Windows OS. Installation of Linux, Awareness of various programming and scripting languages and listing of top 10 languages. Open-source Tools and Technologies. Github and its usage for software development.

Fundamentals of problem solving and introduction to C-language: Algorithm and flowchart & advantages of algorithm (pseudo code),basic flow chart symbols**,** structure of C program with example**, C** language & its features, C tokens, data types in C **,**variables, constants, input / output functions

Operators: (unary operator, assignment operator, arithmetic operator, relational operators, logical operators & bit-wise operator, conditional operator, increment and decrement operator, special operator).

Expressions &statements: Post fix, primary, prefix, unary, binary, ternary & assignment

Unit2:

Branching constructs

Conditional statements: if statement, if-else statement, nested if, switch statement.

Unconditional statements: break and continue statement, Go to statement, return statement

Iterative statements (loops): while loop, do while, difference between while and do while for loop.

Arrays: one dimensional array, two dimensional array, searching techniques, sorting.

Unit -3:

Functions: function definition, types of functions, location of function in a program, structure of a function, parameter passing mechanisms, call by value & call by address.

Strings: string operations with and without using inbuilt string functions (string length, string compare, string copy, string concatenation, string reverse).

Unit -4:

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

Pointers: Introduction to pointers.

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

Command Line Arguments: argc, argv with simple examples, Introduction to UNIX commands.

Self Learning component:

Fundamentals of computer graphics: output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives, two- d i m e n s i o n a l Geometric Transformation.

Inline Assembly Language Program: Simple inline assembly, Extended Assembly Syntax Microsoft C Compiler.

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL SOFTWARE SERIES, 2005.
2. Herbert Schildt, C: The Complete Reference, 4th edition, TATA McGRAW Hill, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, “Computer Concepts and C Programming: A Holistic Approach”, second edition, PHI, 2008.
4. Nanjesh Bennur, Dr. C.K. Subbaraya, “Programming in C”, 2nd Edition, Excellent Publishing House, 2015.

REFERENCE BOOKS:

1. E. Balaguruswamy,” Programming in ANSI C”, 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker, “Computer Graphics C Version”, second edition, PearsonEducation, 2004.

B18CS1040	Basic Electrical and Electronics Engineering	L	T	P	C
Duration:14 Wks		4	0	0	4

Prerequisites:

Fundamentals in Engineering, Mathematics and Physics.

Course Description:

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

Course Objectives:

The objectives of this course are to:

1. Explain the basics of electrical and electronics engineering terminologies.
2. Distinguish the single and three phase systems.
3. Illustrate the different building blocks in digital electronics using logic gates and explain simple logic functions using basic universal gates.
4. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.

Course Outcomes:

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

CO1. Outline the basics of electrical engineering terminology and the usage.

CO2. Identify the Differences between single and three phase systems and learn the working of the same.

CO3. Design different building blocks in digital electronics using logic gates.

CO4. Analyze the applications of diode in rectifiers, filter circuits and wave shaping.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	3	1	2	1	-	-	-	-	-	-	3	-	-

CO 2	1	3	2	2	1	-	-	-	-	-	-	-	3	-	-
CO 3	2	2	2	2	1	-	-	-	-	2	-	-	3	-	-
CO 4	3	3	3	1	1	-	-	-	-	-	-	-	3	-	-

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

Course Content:

UNIT-1:

Introduction to Basic Concepts & Single-Phase AC Circuits: A. Basic Concepts: Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited independent voltage sources; Power and energy. Electromagnetism*:* Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields. Introduction to DC Circuits.

Single Phase AC Circuits: Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits.

UNIT-2:

Three Phase AC Circuits and Transformers: A. AC Circuits:; Three Phase A.C. Circuits covering,Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power (Expression for Power in Star and Delta, No numerical)

B. Transformers: Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation;

UNIT-3:

Digital Electronics: Introduction, Switching and Logic Levels, Digital Waveform (Sections 9.1 to 9.3). Number Systems: Decimal Number System, Binary Number System, Converting Decimal to Binary, Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary, Converting Hexadecimal to Decimal, Converting Decimal to Hexadecimal, Octal Numbers: Binary to Octal Conversion. Complement of Binary Numbers. Boolean Algebra Theorems, De Morgan's theorem.

Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NOR Gate. Algebraic Simplification, NAND and NOR Implementation, NAND Implementation, NOR Implementation. Half adder, Full adder.

UNIT 4:

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 (only qualitative approach), Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator. Numerical examples as applicable.

Self-learning components:

Bipolar Junction Transistors: BJT operation, BJT Voltages and Currents, BJT amplification, Common Base, Common Emitter and Common Collector Characteristics, Electromagnetism: Electromagnetic Induction, Electromagnetic Pulse and Electromagnetic Radiation.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Theodore Wildi, "Electrical Machines, Drives, and Power, 5thSystems", Pearson Edition, 2007.
2. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.
3. International Journal of Electrical Power and Energy Systems (https://www.journals.elsevier.com/international-journal-of-electrical-power-and-energy-systems)
4. Journal of Electrical Engineering (https://link.springer.com/journal/202)

B18CS1050	Environmental Science	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Basic knowledge of Environmental Science studied at higher secondary & school level.

Course Description:

Environmental Science is a multidisciplinary subject which includes various aspects from physics, chemistry, Ecology, Biology, Earth science & Engineering etc. Environmental Studies includes the introduction to environment, Objectives & guiding principles of Environmental education, environmental ethics, Components of Environment, Impacts of Engineering/human activities on environment, Sustainable development, Role of individual and government in environmental Protection, and various various topics related to environmental science imparted through this course.

Course Objectives:

The objectives of this course are to:

1. Discuss Foster clear awareness and concern about economic, social, political and ecological interdependence in urban and rural area.
2. Influence the new patterns of behaviors of individuals, groups and society as a whole towards the environment.
3. List the knowledge values, attitudes, commitment and skills needed to protect and improve the environment.
4. Elaborate the evaluation of the environmental measures and education programs.

Course Outcomes:

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

CO1 : Understand, analyze and execute favorable environmental conditions and the role of individual, government and NGO in environmental protection.

CO2 : List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution controlled products.

CO3 : Get motivation to find new renewable energy resources with high efficiency through active research and innovation.

CO4 : Critically analyzes the ecological imbalances and provide recommendations to protect the environment.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	3	1	-	-	-	2	-	-	-	-	-	1	-	-
CO 2	3	2	2	-	-	-	2	-	-	-	-	-	1	-	-
CO 3	2	2	3	-	-	-	3	-	-	-	-	-	1	-	-
CO 4	2	3	1	-	-	-	2	-	-	-	-	-	1	-	-

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

Course Content:

UNIT-1:

Multidisciplinary nature of environmental studies: Introduction to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment, environmental protection

Role of Government-Assignments of MOEF, Functions of central and state boards, Environmental Legislation s, Initiative and Role of Non-government organizations in India and world.

UNIT-2:

Environmental pollution, degradation & Waste management: Environmental Pollution – Definition, sources and types, Pollutant-Definition& classification, Concepts of air pollution, water pollution, Soil pollution, Automobile pollution-Causes, Effects & control measures. Environmental degradation – Introduction, Global warming and greenhouse effect, Acid rain-formation & effects,

Ozone depletion in stratosphere and its effect. Solid Waste management – Municipal solid waste, Biomedical waste, Industrial solid waste and Electronic waste (E-Waste).

UNIT-3:

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

Natural resources –water resource (Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance), Mineral resources (Types of minerals, Methods of mining & impacts of mining activities),Forest wealth (Importance, Deforestation-Causes, effects and controlling measures)

UNIT 4:

Ecology and ecosystem: Ecology-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem-Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity. Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

Self-learning component:

Waste water treatment processes, hydrology and modern methods adopted for mining activities, remote sensing and its applications, disaster management, case studies of Bhopal gas tragedy, Chernobyl nuclear disaster, London smog.

TEXT BOOKS:

1. R.J. Ranjit Daniels and Jagadish Krishnaswamy, Co-authored &Customised by Dr.MS Reddy & Chandrashekar, "Environmental Studies", Wiley India Private Ltd., New Delhi (Authors from REVA University), 2017.
2. Benny Joseph, "Environmental Studies" -Revised Edition, Tata McGraw – Hill PublishingCompany Limited, 2017.
3. Ashish Shukla, Renu Singh, Anil Kumar, Environmental Science, Revised Edition ,IK International Publishing House Pvt.Ltd, 2018.
4. Dr.S.M.Prakash, Environmental Studies by Elite Publishers Mangalore, 2017.
5. R.J. Ranjit Daniels and JagadishKrishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2009.
6. G. Tyler Miller, Scott E. Spoolman, Environmental Sciences, Cengage Learning, 14th Edition, 2015.

REFERENCE BOOKS:

1. BharuchaErach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmadabad, India, 2017.
2. Rajagopalan R.," Environmental Studies – from Crisis to cure", Oxford University Press, 2017.
3. Environmental Science by Arvind walia, Kalyani Publications, 2018.
4. Jadhav, H &Bhosale, V.M. Environmental Protection and Laws. Revised Edition, Himalaya Pub.House, Delhi, 2018.
5. Sharma B.K., Environmental Chemistry. Goel Publ. House, Meerut, 2018.

B18CS1060	Technical English – I	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Fundamentals of Spoken English.

Course Description:

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

Course Objectives:

The objectives of this course are to:

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

Course Outcomes:

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

CO1. Interpret audio files and comprehend different spoken discourses/excerpts in different accents (Listening Skills).

CO2. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).

CO3. Make use of reading different genres of texts adopting various reading strategies (Reading Skills).

CO4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic (Writing Skills).

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-
CO 2	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-
CO 3	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-
CO 4	-	-	-	-	-	-	-	1	3	2	-	3	-	-	-

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

Course Content:

UNIT-1:

Functional English: Grammar: Prepositions; Modal Auxiliaries, Listening: Listening to audio (verbal sounds), Speaking: Debating Skills, Reading: Skimming a reading passage; Scanning for specific information, Writing: Email communication

UNIT-2:

Interpersonal Skills: Grammar: Tenses; Wh-question s, Listening & Speaking: Listening and responding to video lectures / talks, Reading: Reading Comprehension; Critical Reading; Finding key information in a given text, Writing: Process descriptions (general/specific); Recommendations

UNIT-3:

Multitasking Skills Grammar: Conditional Sentences, Listening & Speaking: Listening to specific task; focused audio tracks and responding, Reading: Reading and interpreting visual material, Writing: Channel conversion (flowchart into process); Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making

UNIT 4:

Communication Skills Grammar: Direct and indirect speech, Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays, Reading: Making inference from the reading passage; predicting the content of a reading passage, writing: Interpreting visual materials (line graphs, pie charts etc.); Different types of Essay Writing.

TEXT BOOKS:

1. Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 2010.

2. Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 2012.

3. Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.

REFERENCES BOOKS:

1. Murphy, Raymond. Murphy's English Grammar with CD. Cambridge University Press, 2004.

2. Rizvi, M. Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill, 2005.

3. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.

4. Senet al. Communication and Language Skills. Cambridge University Press, 2015.

B18CS1070	Basic Electrical and Electronics Engineering Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Nil.

Course Description

The Course covers conduction of experiments to Analyze, Design and simulate mechanism of FUSE, MCB, for two-way switch or staircase wiring, to determine the additive and subtractive polarity of a single- phase transformer, Determination of VI characteristics Zener Diode, Silicon Diode, Half Wave rectifier using Diode.

Course Objectives:

The objectives of this course are to:

1. Build a broad concept of various types of electrical apparatus, tools and instrumentation.
2. Provide hands on experience with electrical apparatus and electrical safety norms.
3. Analyze the schematics for making electrical connection of different appliances.
4. Develop collecting and interpreting experiment all data, writing skills in students.

Course Outcomes (COs)

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

CO1: Make use of the basic knowledge of electrical terminology in conducting the experiments.

CO2: Differentiate between single and three phase systems and learn the working of the same.

CO3: Develop different building blocks in digital electronics using logic gates and implement simple logic functions using basic universal gates.

CO4: Design diodes inrectifiers, filter circuits and waveshaping.

CO, PO & PSO MAPPING:

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

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	2	-	2	-	-	-	1	1	-
CO2	2	2	-	-	-	-	2	-	2	-	-	-	1	1	-

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

Course Content:

List of Experiments

Introduction to Simulation tools: PSPICE 9.1 Student Version- Design and simulate analog and digital circuits, Digital Simulator -Digital Simulator has a toolbar of digital circuit elements, including logic gates, flip-flops, switches, and indicators.

SL. NO.	EXPERIMENT
1.	Electrical Safety Training. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment. To study the Importance and mechanism of FUSE.
2.	Home Electrical Wiring Demonstration 1. To study the Importance and mechanism of MCB.
3.	Home Electrical Wiring Demonstration 2. To study & verify the connection procedure for fluorescent lamp wiring. To study the connection of Fan with switch and regulator.
4.	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring.
5.	Behavior of current and voltage in series and parallel circuits. To study and verify the behavior of current and voltage in series circuit. To study and verify the behavior of current and voltage in parallel circuit.
6.	Polarity test on single phase transformer. To determine the additive polarity of a single- phase transformer. To determine the subtractive polarity of a single- phase transformer.

TEXT BOOKS:

1. Nagrath I.J. and D. P. Kothari), Basic Electrical Engineering, Third Edition Tata McGraw Hill, 2009.

7.	Polarity test on single phase transformer. To determine the subtractive polarity of a three- phase transformer.
8.	Determination of VI characteristics of Zener Diode
9.	Determination of VI characteristics of Silicon Diode
10.	Design and Analysis of a Half Wave rectifier using Diode
11.	Characterristics of BJT in Common Emitter Configuration
12.	Characterristics of JFET in Common Source Configuration
13.	Half Wave and Full Wave Rectifier Without Filter
14.	Half Wave and Full Wave Rectifier with Filter

2. Hayt and Kimberly, Engineering Circuit Analysis, 8th Edition, Tata McGraw Hill, 2013.

3. Kulshreshtha D.C., Basic Electrical Engineering, Tata McGraw Hill, 2009.

4. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall, India, 2009.

5. Hughes, E., Electrical Technology, Pearson, 2005.

6. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.

7. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.

REFERENCE BOOKS:

1. Theodore Wildi, "Electrical Machines, Drives, and Power, 5thSystems", Pearson Edition, 2007.

2. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.

3. International Journal of Electrical Power and Energy Systems (https://www.journals.elsevier.com/international-journal-of-electrical-power-and- energy-systems)

4. Journal of Electrical Engineering (https://link.springer.com/journal/202)

B18CS1080	Chemistry Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Students taking this course shall have the knowledge of the following:

1. Handling glassware, apparatus, Acids, Bases toxic chemicals and safety precautions in the laboratory.
2. Chemical awareness and basic chemical reactions.

Course Description:

The Course covers conduction of experiments to analyze the material present in a sample using different methods, qualitative and quantitative analysis of materials, testing hardness of water and other experiments using various methods.

Course Objectives:

1. Distinguish qualitative and quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence
2. Analyse different instrumental and titrimetric methods for estimation of the samples
3. Discuss the hardness and impurities in water
4. Explain ions present in unknown substance/ores using titrimetric and instrumental metals

Course Outcomes:

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

CO1: Analyze the amount of material present in the sample by different instrumental methods.

CO2: Evaluate the amount of oxygen demand, alkalinity, and hardness of the different water samples.

CO3: Estimate impurities in water.

CO4: Test the ions present in unknown substance/ores using titrimetric and instrumental metals

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	-	-	-	-	-	-	3	3	-	-	1	-	-
CO 2	2	3	-	-	-	-	-	-	2	2	-	-	1	-	-

CO 3	3	2	-	-	-	-	-	-	3	2	-	-	1	-	-
CO 4	2	3	-	-	-	-	-	-	2	1	-	-	1	-	-

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

Lab Experiments:

Sl No	List of Experiments
1.	Potentiometric Estimation of Mohr's salt.
2.	Colorimetric estimation of copper.
3.	Conductometric estimation of acid mixture using standard NaOH.
4.	Determination of pKa of given weak acid using pH meter.
5.	Determination of viscosity co-efficient of a given organic Liquid.
6.	Determination of total hardness of the given water sample.
7.	Determination of calcium oxide in the given cement sample.
8.	Determination of COD of the given waste water sample.
9.	Determination of percentage of copper in the given brass sample.
10	Determination of iron in the given sample of Hematite ore using Potassium dichromate.
11	Estimation of Alkalinity of the given water sample using standard HCl solution
12	Flame photometric estimation of sodium in the given water sample.
13	Electroplating of Copper and Nickel.
14	Determination of Calcium in a milk sample.

II Semester
Syllabus

B18CS2010	Probability and Statistics	L	T	P	C
Duration:14Wks		4	0	0	4

Prerequisites:

Knowledge of statistics – mean, mode, median, and knowledge of set theory, permutation and combination, baics of probability theory.

Course Description:

This course covers concepts of curve fitting, data interpretation, probability distributions and sampling analysis. This course provides an elementary introduction to probability and statistics and applications with basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, confidence intervals and linear regression.

Course Objectives:

The objectives of this course are to:

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

Course Outcomes (COs):

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

CO1 : Solve the problems of Curve fitting and regression in various problems in Computer Science & Engineering fields.

CO2 : Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.

CO3 : Develop a stochastic problem as Markov model as a problem solving methods for systematic model buildings.

CO4 : Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-

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

Course Contents:

UNIT- 1

Curve Fitting: Curve fitting by the method of least squares and fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$ and $y = ax^b$

Statistical Methods: Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression, problems. Rank correlation. Applications in computer science.

UNIT -2

Probability distributions: Recap of probability theory (definition, addition rule, multiplication rule, conditional probability). Random variables, Discrete and continuous probability distributions. Binomial, Poisson, exponential and normal distributions (derivation of mean and variance for all distributions). Applications in computer science.

UNIT- 3

Joint Probability distribution: Joint Probability distribution for two discrete random variables (both discrete and continuous cases), expectation, covariance, correlation coefficient.

Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. Applications in computer science.

UNIT- 4

Sampling theory: -Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications in Computer Science.

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

Self-learning components:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B18CS2020	Physics	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

The fundamental concepts in physics related to atomic physics, electricity and magnetism, mechanics, waves and optics.

Course Description:

This course introduces the basic concepts of Physics and its applications to Computer Science Engineering courses by emphasizing the concepts underlying four units: Wave Mechanics, Lasers and optical fibres, Display Technology, superconductors, Quantum computation and Nano materials. The subject has basic laws, expressions and theories which help to increase the scientific knowledge to analyse upcoming technologies.

Course Objectives:

The objectives of this course are to:

1. Impart the knowledge about wave mechanics and its applications
2. Demonstrate the different applications of lasers, and optical fibers
3. Discuss different types of display technologies, superconductors and its applications
4. Explain the importance of quantum computation, nanomaterials, synthesis and application

Course Outcomes (Cos):

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

CO1: Apply the role of wave mechanics and uncertainty in quantum physics to solve time-dependent and independent Schrodinger equations for particle in a well. (Apply)

CO2: Demonstrate the working of LASER and its application in holography and optical fiber communications (Understanding, Analysis)

CO3: Summarize superconductivity with applications and demonstrate touch screen and display Technologies. (Comprehension, Application)

CO4: Make use of synthesis of nano-materials like CNTs and basics of quantum computation (Analysis)

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	-	1	-
CO 2	3	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 3	3	1	2	-	-	-	-	-	-	-	-	-	-	1	-
CO 4	3	1	1	-	-	-	-	-	-	-	-	-	-	1	-

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

Course Contents:

UNIT- 1

Wave mechanics: Introduction to Wave mechanics, De-Broglie hypothesis. Expression for de-Broglie wavelength of an electron in terms of accelerating potential. Phase velocity and group velocity, Relation between phase velocity and group velocity.

Quantum Physics**:** 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 with numerical examples. Application-Quantum computation.

UNIT- 2:

Lasers: Lasers Interaction between radiation and matter (induced absorption, spontaneous and stimulated emission). Expression for energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser operation (population inversion and Meta stable state). Requisites of laser system, Construction and working of Carbon Dioxide (CO2) laser &semiconductor laser and their applications. Applications: Holography (recording and reconstruction of images) and its applications.

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 (Photo diode)and their applications. Advantages and limitations of optical communications.

UNIT- 3

Superconductors: Zero resistance, Critical temperature (Tc), Critical field (Hc), Critical current density (Jc), Perfect diamagnetism, Meissner effect, Type I and Type II superconductors, Isotope effect, BCS theory of superconductivity, Applications-Superconducting magnets and Maglev vehicle. Display technology: Touch screen technologies: Resistive and capacitive touch screen and Displays:CRT, Field emission display, Plasma display, LED display, OLED display, LCD display.

UNIT- 4

Nanomaterials: Introduction to nano science, nanomaterials and their applications, Synthesis of nanomaterials using bottom-up method (arc-discharge method), top-down methods (ball milling method), Carbon Nanotubes: properties and applications. Quantum Computation: Quantum wires (one dimensional), Quantum dots (zero dimensional); the idea of "qubit" and examples of single qubit logic gates- Classical bits, Qubit as a two level system.

Self-learning component:

Introduction to haptics. Magnetic storage devices, solid state storage devices, optical storage devices, and characteristics of materials used in manufacture of laptops/desktops (body, internal circuit connection), heat sink cooling, liquid cooling, fan-based cooling, laser printer working, accelerometers. Gold nano particles as storage devices

TEXT BOOKS:

1. William T. Silfvast, Laser Fundamentals, Cambridge University press, New York, 2004

2. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, John Wiley and Sons, New York, 10thedition 2013.

3. R. K. Gaur and S.L. Gupta, Engineering Physics, DhanpatRai Publications (P) Ltd, New Delhi. 53rd edition, 2014.

4. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, 2014.

REFERENCE BOOKS:

1. CharlsKittel, Introduction to Solid State Physics, Wiley, Delhi,8th Edition, 2004

2. Athur Beiser, Concepts of modern Physics, Tata McGraw Hill publications, New Delhi, 8th Edition, 2011

3. S. O. Pillai, Solid State Physics, New Age International publishers, New Delhi, 2010

4. Janglin Chen, Wayne Cranton, Mark Fihn, Handbook of Visual Display Technology, Springer Publication, Second edition 2012.

B18CS2030	Object Oriented Programming	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for problem solving [B18CS1030]

Course Description:

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

Course Objectives:

The objectives of this course are to:

1. Explain the basic concepts of objects and classes for a real-world application.
2. Illustrate the use of operator overloading/function overloading for given applications.
3. Demonstrate the use of inheritance in real world applications.
4. Describe I/O streams and Templates and Exception Handling.

Course Outcomes:

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

CO1: Apply the basic concepts of objects and classes for a real-world application.

CO2: Utilize operator overloading / function overloading in given real world applications.

CO3: Develop programs using Inheritance feature of object-oriented programming.

CO4: Design and develop programs using I/O streams, Templates and Exception Handling.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	3	L	-	-	-	-	-	-	-	3	2	3
CO 2	2	2	2	2	1	-	-	-	-	-	-	-	2	2	2
CO 3	3	2	3	3	2	-	-	-	-	-	-	1	3	2	3

CO 4	3	2	3	3	2	-	-	-	-	-	-	2	3	2	3

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

Course Content:

UNIT-1

Introduction: Introduction to object-oriented concepts: Encapsulation, Abstraction, Inheritance, Polymorphism, Overview of OOP, Introduction to object-oriented modelling,

Introduction to variables in C++, I/O operators, Function overloading, Inline function, Recursive function.

Classes & Objects: Introduction to Classes, Member Functions and Member data, Constructors and Destructors, Static Class members.

UNIT-2:

Operator over loading: Introduction to Objects, Array of Objects, Dynamic Objects, Pointers to objects, Friend Function, Access specifiers.

The scope resolution operator, Generic functions and classes, Operator overloading using

Friend function: Unary operator '+' & binary operator, Copy constructor.

UNIT-3:

Inheritance: Base Class, Inheritance and Protected members, inheriting multiple base classes, Constructors, Destructors and Inheritance, Virtual base classes. Virtual functions and Polymorphism: Virtual functions, pure virtual functions, Early and late binding.

UNIT-4:

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

Self-Learning Components:

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

TEXT BOOKS:

1. HerbertSchildt: The Complete Reference C++,4th Edition, Tata McGrawHill,2003.

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

REFERENCE BOOKS:

1. PaulJDeitel, Harvey MDeitel: C++ for Programmers, Pearson Education,2009.
2. KR Venugopal, Rajkumar Buyya, T RaviShankar: Mastering C++, Tata McGraw Hill,1999.
3. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).
4. ACM Journal on Object-Oriented Programming

B18CS2040	Technical English – II	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Fundamentals of Spoken English.

Course Description:

This course aims at utilizing the ability of using language skills effectively in real-life scenarios, to develop the learners' competence in employ ability skills, to improve the habit of writing, leading to effective and efficient communication, to prioritize specially on the development of technical reading and speaking skills among the learners.

Course Objectives:

The objectives of this course are to:

1. Enable learners of Engineering and Technology develop their basic communication skills in English
2. Emphasize specially the development of speaking skills amongst learners of Engineering and Technology
3. Ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication

Course Outcomes:

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

CO1: Organize their opinions clearly and meaningfully.

CO2: Demonstrate the ability to speak appropriately in social and professional contexts.

CO3: Build inferences from the text.

CO4: Take part in interviews confidently and develop accurate writing skills using different.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-
CO 2	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-

CO 3	-	-	-	-	-	-	-	1	2	2	-	3	-	-	-
CO 4	-	-	-	-	-	-	-	1	3	2	-	3	-	-	-

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

Course Content:

UNIT-1:

Language Acquisition: Grammar: Active and passive voice, Listening & Speaking: Listening to informal conversations and interacting, Reading: Developing analytical skills; Deductive and inductive reasoning, Writing: Giving Instructions; Dialogue Writing

UNIT-2:

Persuasive Skills Grammar: Compound words; Phrasal verbs, listening: Listening to situation based dialogues. Speaking: Group Discussions, Reading: Reading a short story or an article from newspaper; Critical reading, writing: Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives)

UNIT-3:

Cognitive Skills Grammar: Homonyms; homophones, listening: Listening to conversations;
Understanding the structure of conversations, speaking: Presentation Skills, Reading: Extensive reading, Writing: Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions - interpretation of data using charts, PPT); Precis Writing.

UNIT 4:

Employ ability Skills Grammar: Idioms; Single Word Substitutes, listening: Listening to a telephone conversation; viewing model interviews (face-to-face, telephonic and video conferencing), Speaking: Interview Skills, Mock Interviews, Reading: Reading job advertisements and the profile of the company concerned, Writing: Applying for a job; Writing a cover letter with resume / CV.

Self-learning components:

Active listening, basic phone skills, mobile personality and E-mail communication.

TEXT BOOKS:

1. Thorpe, Edgar and Showick Thorpe. Objective English. Pearson Education, 2013.

2. Dixson, Robert J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd., 1988.

3. Turton, Nigel D. ABC of Common Errors. Mac Millan Publishers, 1995.

REFERENCE BOOKS:

1. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013.

2. Raman, Meenakshi and Sangeetha Sharma. Technical Communication. Oxford University Press, 2015.

3. Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.

4. Kumar, E Suresh, J. Savitri and P Sreehari (ed). Effective English. Pearson Education, 2009.

5. Goodale, Malcolm. Professional Presentation. Cambridge University Press, 2013.

B18CS2050	Indian constitution and professional ethics	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Intermediate level Constitution of India and Professional Ethics.

Course Description:

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

Course Objectives:

The objectives of this course are to:

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

Course Outcomes:

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

CO1: Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.

CO2: Demonstrate the practicality of Constitution perspective and make them face the world as a bonafide citizen.

CO3: Illustrate the professional ethics and human values.

CO4: Summarize ethical standards followed by different companies.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	2	2	2	-	1	-	-	-

CO 2	-	-	-	-	-	-	-	3	2	2	-	1	-	-	-
CO 3	-	-	-	-	-	-	-	3	2	2	-	1	-	-	-
CO 4	-	-	-	-	-	-	-	3	2	2	-	1	-	-	-

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

Course Content:

UNIT-1:

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

UNIT-2:

Human Rights: Nature and Scope of human rights, Universal protection of human rights (UDHR),Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups (children, women & old-age). Human values: Truth, Honesty, Loyalty, Love, Peace with examples, Difference between ethics, beliefs and morals.

UNIT-3:

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

UNIT 4:

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

Self-learning component:

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

TEXT BOOKS:

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

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

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

REFERENCE BOOKS:

1. Meron Theodor, Human Rights and International Law Legal Policy Issues, Vol. 1 and 2, Oxford University, Press, New Delhi, 2000.
2. M V Pylee, An Introduction to Constitution of India.
3. Dr. Durga Das Basu, Introduction to constitution of India.

B18CS2060	Computer Aided Engineering Drawing Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Nil

Course Description:

The Course provides an introduction to engineering drawing which is one of the most important tool for an engineer. The Course covers fundamentals of drawing points, lines, planes and solid objects with different types of projections.

Course Objectives:

1. Discuss the fundamental concepts of engineering drawing.
2. Explain the component descriptions as per the commonly practiced standards.
3. Explore 2D drawings of points, lines, planes and solids in sketch book.
4. Describe Orthographic projections and development of solids using solid edge software in computer.

Course Outcomes:

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

CO1: Apply various concepts to solve practical problems related to engineering drawing.

CO2: Identify component descriptions as per the commonly practiced standards.

CO3: Construct 2D drawings of points, lines, planes and solids in sketch book.

CO4: Create Orthographic projections and development of solids using solid edge software in computer.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	3	-	-	-	-	-	-	-	-	-	-
CO 2	3	1	1	1	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	3	2	3	-	-	-	-	-	-	-	-	-	-

CO 4	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-

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

List of Experiments

Sl.No.	NAME OF THE EXPERIMENT
1.	A point 30 mm above XY line is the front view of two points A and B. The top view of A is 40 mm behind VP and the top view of B is 45 mm infront of VP. Draw the projections of the points and state the quadrants in which the points are situated.
2.	Draw the projections of the following points on the same XY line, keeping convenient distance between each projector. Name the Quadrants in whey they lie. E - 30 mm below HP and 25 mm behind VP. F - 35 mm below HP and 30 mm infront of VP. G - on HP and 30 mm infront of VP. H - on HP and 35 mm behind VP.
3.	A line has its end A 10 mm above HP and 15 mm infront of VP. The end B is 55 mm above HP and line is inclined at 30º to HP and 35º to VP. The distance between the end projectors is 50 mm. Draw the projections of the line. Determine the true length of the line and its inclination with VP.
4.	The front view of a 90 mm long line which is inclined at 45º to the XY line, measures 65 mm. End A is 15 mm above the XY line and is in VP. Draw the projections of the line and find its inclinations with HP and VP.
5.	A triangular plane lamina of sides 25 mm is resting on HP with one of its corners touching it, such that the side opposite to the corner on which it rests is 15 mm above HP and makes an angle of 30º with VP. Draw t6he top and front views in this position. Also determine the inclination of the lamina to the reference plane.
6.	A pentagonal lamina of edges 25 mm is resting on HP with one of its sides such that the surface makes an angle of 60 º with HP. The edge on which it rests is inclined at 45 º to VP. Draw its projections.
7.	A square prism 35 mm sides of base and 60 mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the prism when the axis of the prism is inclined to HP at 40º and to VP at 30º.
8.	A hexagonal prism 25 mm sides of base and 50 mm axis length rests on HP on one of its edges. Draw the projections of the prism when the axis is inclined to HP at 45º and appears to be inclined to VP at 40º.
9.	A pentagonal pyramid 25 mm sides of base sand 50 mm axis length rests on HP on one of its edges of the base. Draw the projections of the pyramid when the axis is inclined to HP at 45º and VP at 30º.

10.	A hexagonal pyramid 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base. Draw the projections of the pyramid when the axis is inclined to HP at 45 º and VP at 30 º.
11.	A regular pentagonal pyramid of side of base 35mm and altitude 65mm has its base on HP with a side of base perpendicular to VP. The pyramid is cut by a section plane which is perpendicular to the VP and inclined at 300 to HP. The cutting plane meets the axis of the pyramid at a point 30mm below the vertex. Obtain the development of the remaining part of the pyramid.
12.	A right cone of 55mm diameter of base and 75mm height stands on its base on HP. It is cut to the shape of truncated cone with its truncated surface inclined at 450 to the axis lying at a distance of 40mm from the apex of the cone. Obtain the development of the lateral surface of the truncated cone.

B18CS2070	Object Oriented Programming Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Knowledge of any programming Languages like Programming for problem solving(B18CS1030)

Course Description:

This course helps students to understand the fundamentals of object-oriented concepts to develop solutions for various application problems.

Course Objectives:

1. Explain the fundamentals of OOPS concepts that is required to develop simple programs.
2. Discuss object-oriented programming to visualize problems in terms of objects
3. Describe models like encapsulation, inheritance and polymorphism in programs .2030
4. Describe I/O streams and Templates and Exception Handling.

Course Outcomes:

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

CO1: Apply good programming style and understand the impact of style on developing and maintaining programs.

CO2: Design object-oriented solutions for small systems involving multiple objects.

CO3: Illustrate the use of object-oriented programming model: abstract data types, encapsulation, inheritance and polymorphism.

CO4: Design and develop an object-oriented software for larger systems of Industry relevance.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	2	2	-	-	3	3	-	-	3	3	3
CO 2	2	2	3	2		1	-	-	3	3	-	-	3	3	3

CO 3	3	1	2	2	2	1	-	-	3	3	-	-	3	3	3
CO 4	2	2	2	2	2	2	-	-	3	3	-	-	3	3	3

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

List of Experiments:

Experiment Nos.	Programs
1	Write a C++ program to create a class EMPLOYEE, with data members Name- First name, last name, Address, Employee_Number, salary. Define functions to read values from the user and display the same.
2	An election is contested among 5 candidates. Each candidate is identified by their code(1,2,3,4,5) and voting is done by entering the code of the candidate in the ballot paper. Write a C++ code to count the number of votes for each candidate and declare the candidate person with highest number of votes as winner. Note: any value in the ballot paper other than the candidate code is considered as "None Of The Above" (NOTA). If NOTA gets the highest
3	The HR of the company decides to store the concatenated names(first name and last name) of the employees in database. Write a C++ program to use copy constructor for concatenation of names. String S1="Ram", S2 = "Sharma". S3=S1+S2
4	Perform addition of two complex numbers by overloading binary plus operator(+) operator using friend function.
5	Write a C++ program to print the Fibonacci series 0 1 1 2 3 5 8 13 …. By getting a number as input and print those many values in the series as output. Example: if 5 is given as input, it should print first 5 numbers of the series 0 1
6	Database of student contains Name, age, year, semester and marks score. The grade is calculated according to their percentage of marks scored. a. 90 % and above - S grade b. 80% to 89% -- A grade c. 70% to 79% -- B grade d. 60% to 69% -- C grade Write a C++ program to create object for the student and print their grade.
7	Write a Program to design a student class representing student roll no. and a test class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sports and test class should be inherited by a result class having the functionality to add the scores and display the final result for a student.

8	Write a program to find maximum of two numbers using friend function.(note: one number is member of class ONE and other number is a member of class TWO.)
9	Area can be computed for any polygon. Calculate and return the area of rectangle and triangle by defining a single virtual function Area(). Write a C++ program to use virtual function (polymorphism)
10	A simple calculator performs different arithmetic operations such as addition, subtraction, division, modulus and multiplication. Write a C++ program for a simple calculator using inline function and handle the exception for divide by zero.
	Additional programs
11	Define a class in C++ with following description: Private Members: A data member Flight number of type integer A data member Destination of type string A data member Distance of type float A data member Fuel of type float A member function CALFUEL() to calculate the value of Fuel as per the following criteria Distance Fuel <=1000 500 more than 1000 and <=2000 1100 more than 2000 2200 Public Members : INFO () to allow user to enter values for Flight Number, Destination, Distance & call function CALFUEL() to calculate the quantity of Fuel SHOWINFO() to allow user to view the content of all the data members
12	Write a C++program to design a class called complex to represent a complex number. The complex class must use a external function (use it as friend function) to add two complex numbers. The function should return an object of type complex representing the sum of two numbers.
13	Write a C++ program to demonstrate the inheritance in the animal kingdom.
14	Write a C++ program to read infix arithmetic expressions as input from a file, evaluates all of the expressions, and writes the resulting answers to the standard output
15	Write a C++ program to write number 1 to 100 in a data file NOTES.TXT.
16	Write a C++ program to create a file of student info and store the information about 10 students. The attributes of each student are as below: Name, SRN, Sem, Discipline.
17	Write a C++ program to print half pyramid using alphabets.
18	Write a C++ program to print characters through ASCII value using count
19	Write a C++ program to access public data members inside main function using pointers.
20	Write a C++ program to print the size of different types of pointers along with value addresses

B18CS2080	Physics Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites

Intermediate Physics

Course Description

The course covers fundamentals of engineering physics that involves conducting experiments to study the characteristics of components like laser, semiconductor materials, optical fibres, capacitors, solar cell etc.

Course Objectives:

1. Explain fundamental characteristics of components like semi conductors, laser etc.
2. Discuss new technology in physics and compare its results with theoretical calculations.
3. Describe observed optical phenomena in nature.
4. Enumerate physical properties of material

Course Outcomes:

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

CO1: Develop experiments to identify the characteristics of components like semi conductors, laser etc.

CO2: Apply the knowledge of new technology in physics and comparison of results with theoretical Calculations.

CO3: Analyze observed optical phenomena in nature.

C04: Design experiments to calculate physical properties of material.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3						3	2				1	
CO 2	3	1	1	-	-	-	-	-	3	2	-	-	-	1	-
CO 3	3	1	2	-	-	-	-	-	3	2	-	-	-	1	-

CO 4	**3**	**1**	**1**	-	-	-	-	-	**3**	**2**	-	-	-	**1**	-

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

List of Experiment

Sl. No.	**EXPERIMENT**
1	To find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method
2	To find the band gap of intrinsic semi-conductor using four probe method
3	To find the value of Planck's constant by using Light emitting diode
4	To study the V-I characteristics of a zener diode
5	To find the laser parameters–wavelength and divergence of laser light by Diffraction method
6	To study the photo diode characteristics and hence to verify the inverse square law
7	To determine capacitance and dielectric constant of a capacitor by charging and discharging a capacitor
8	Study of attenuation and propagation characteristics of optical fibre cable
9	Determination of Particle size using laser
10	Construction and study of IC regulation properties of a given power supply
11	Study of electrical characteristics of a solar cell
12	Determination of numerical aperture of a given optical fibre
13	Determination of electrical resistivity of Germanium crystal and study the variation of resistivity with temperature by four probe method
14	To Study the characteristics of a given non transistor and to determine current gain and amplification factor in CE mode
15	To determine the resonance frequency and bandwidth of a given LCR circuit (Series and Parallel)

Additional Experiments

1. Study forward and reverse characteristics for a zener diode using the pspice software and find knee voltage and breakdown voltage

2. Study the frequnce response of series and parallel LCR circuits using pspice software

3. Determine current gain, input resistance and output resistance for a transistor by studying its input, output and transfer characteristics using pspice software.

II Year Detailed Syllabus

III Semester
Syllabus

B18CS3010	Digital Logic Design	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Knowledge of Basic Electrical and Electronics Engineering [B18CS1040].

Course Description:

This course covers basic concepts and techniques of combinational and sequential digital logic circuits, notably basic building blocks such as different types of latches, flip flops, registers, synchronous and asynchronous counters.

Course Objectives:

The objectives of this course are to:

1. Explain the construction of K-maps to simplify Boolean expressions.
2. Demonstrate the working of combinational and sequential circuits based on the input conditions.
3. Describe characteristic equations of various types of Flip-Flops and types of shift registers.
4. Illustrate circuit implementation using flip flop based approach and ROM based approach.

Course Outcomes:

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

CO1 Make use the K-map and QM-method to simplify Boolean expression and implement the reduced expression.

CO2 Analyze the behavior of data processing circuits like adders, multiplexers, demultiplexers encoders and decoders and use them for simple applications.

CO3 Illustrate the behavior of different Flip-flops and express their behavior in all possible forms and realizing shift registers.

CO4 Design counters and synchronous sequential circuits using Moore and Mealy model

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	-	3	2	-

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

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

Course Content:

UNIT-1:

Principle and Minimization Techniques of combinational Circuits: Introduction to combinational logic; Minimization Techniques: Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS); 3 and 4 Variable Karnaugh map, Quine-McCluskey method. Introduction to EDA tools for Digital Design.

Application study1**:** Logical Function Unit

UNIT-2:

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. Application study2: Calculator

UNIT-3:

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

Application sudy3: Digital combinational lock

UNIT 4:

Sequential Design: Counters: Analysis of Binary ripple Up/Down counter, Analysis and design of synchronous mod-*n* counter using flip-flop, state machine notation, Introduction to Mealy and Moore model circuits, Sequence detector.

Application study4: Vending machine

Self-learning component:

Memory devices (ROM, RAM), Elevator, Digital clock.

TEXT BOOKS:

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.

REFERENCE BOOKS:

1. Samuel C Lee, “Digital Circuits and Logic Design”, PHI Course Pvt. Ltd., 2008.
2. Charles H Roth Jr., “Fundamentals of Logic Design”, Cengage Course, 5th edition, 2014.
3. John M Yarbrough, “Digital Logic Applications and Design”, Thomson Course, 2001.
4. Donald D Givone, “Digital Principles and Design”, Tata McGraw-Hill 2002

B18CS3020	Analog Electronic Circuits	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Basic Electrical and Electronics Engineering [B18CS1040]

Course Description:

This course covers the design, construction of analog electronic circuits. The main contents are: the basic principles of operation, terminal characteristics, and equivalent circuit models for, transistors, andop-amps.

Course Objectives:

The objectives of this course are to:

1. Demonstrate the working of Bipolar junction transistors with a special focus on common Emitter Fixed bias configuration
2. Illustrate the Field effect transistors and their working principle.
3. Describe the various oscillator circuits and limiters using diodes.
4. Discuss the various analog circuits constructed using Operational amplifier

Course Outcomes (Cos):

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

CO1: Analyse Bipolar junction transistors with a special focus on designing amplifiers with discrete components

CO2: Classify the Field effect transistors and summarise their working principle.

CO3: Build the various oscillator circuits and limiters using diodes.

CO4: Construct various Analog circuits using Operational amplifier.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	3	2	-	-	-	-	-	-	-	3	-	-
CO 2	2	2	2	2	2	-	-	-	-	-	-	-	3	-	-
CO 3	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-

CO 4	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

Course Content:

UNIT- 1

Transistors, UJT and Thyristors:

Operating Point, Common-Emitter Configuration-Fixed-bias, Thermal Runaway, Transistor Switch, Uni junction Transistors, SCR, EDA tool.

UNIT -2

Field Effect Transistors:

Bipolar Junction Transistors versus Field Effect Transistors, Junction Field Effect Transistors, Metal Oxide Field Effect Transistors, Differences between JFETs and MOSFETs, Handling

MOSFETs, Biasing MOSFETs- Voltage divider Bias, FET Applications-Amplifiers, Switches, CMOS Devices.

UNIT- 3

Limiters and Oscillators:

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

UNIT- 4

Operational Amplifiers:

Ideal Op amp versus Practical Op amp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters-First order LPF and HPF, Phase Sifters, Instrumentation Amplifier, Non-Linear Amplifier-Log and anti-log amplifier.

Self-learning component:

Type of amplifier configurations, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter, Sine Wave Oscillators.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Jacob Millman, Christos Halkias, Chetan D Parikh : Millman's Integrated Electronics-Analog and Digital Circuits and Systems,2nd Edition,Tata McGraw Hill,2010.
2. R. D. Sudhaker Samuel: Electronic Circuits, Sanguine-Pearson, 2010.

B18CS3030	Programming with Java	L	T	P	C
Duration:14 Wks		3	0	1	4

Prerequisites:

Programming for Problem Solving [B18CS1030], Object Oriented Programming [B18CS2030], Data Structures [B18CS3040]

Course Description:

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

Course Objectives

The objectives of this course are to:

1. Explain the basic datatypes and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.

Course Outcomes (Cos):

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

CO1: Make use of array concepts in java to store and sort the given raw data.

CO2: Apply the features of OOPS in java to solve the real-world problems.

CO3: Develop program for stack implementation using Exception Handling in java.

CO4: Identify suitable data structures to solve real world applications

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	1	-	-	-	3	3	-	2	3	-	3
CO 2	3	3	2	2	1	-	-	-	3	3	-	2	3	-	3
CO 3	3	3	1	1	1	-	-	-	3	3	-	2	-	3	3

CO 4	**3**	**3**	**3**	**1**	**2**	-	-	-	**3**	**3**	-	**2**	-	**3**	**-**

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

Course Contents:

UNIT- 1

FUNDAMENTAL PROGRAMMING STRUCTURES

Dissecting the "Hello, World" Program; Compiling and Running a Java Program; Primitive Types; Variables; Arithmetic Operations; Strings; Input and Output; Control Flow; Arrays; Functional Decomposition. Introduction to industry 4.0 introduction to framework for working with java.

UNIT -2

OBJECT-ORIENTED PROGRAMMING

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

UNIT- 3

INHERITANCE AND EXCEPTIONS

Extending a Class; Object: The Cosmic Super class; Enumerations; Runtime Type Information and Resources; Exception Handling: Throwing Exceptions; The Exception Hierarchy; Declaring Checked Exceptions; Catching Exceptions; the Try-with-Resources Statement; The finally Clause; Re-throwing and Chaining Exceptions; Uncaught Exceptions and the Stack Trace.

UNIT- 4

GENERIC PROGRAMMING AND COLLECTIONS

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

Self-learning component:

The Eclipse IDE; Streams; Processing Input and Output; Concurrent Programming; Swing and JavaFX; Networking; JDBC Database Access.

TEXT BOOKS:

1. Cay S. Horstmann; Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018.

2. Herbert Schildt; Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018.

3. David Gallardo, Ed Burnette, Robert Mcgovern; Eclipse in Action a guide for java developers, Manning Publications.

4. Ed Burnette; Eclipse IDE Pocket Guide : Using the Full-Featured IDE, O'Reilly Media, Inc, USA.

REFERENCE BOOKS:

1. Cay S. Horstmann; Core Java™ Volume I—Fundamentals, Prentice Hall, Tenth Edition, 2015

2. Joshua Bloch; Effective Java, Addison-Wesley Professional, Third Edition,2017

3. Ken Kousen; Modern Java Recipes, O'Reilly Media, Inc.,2017

4. Oracle Java Documentation. (https://docs.oracle.com/javase/tutorial/)

Sample Assignments for Internal Assessment:

Use Java Programming Language to complete the assignment.

Assignment	Description	Concepts
SCIENTIFIC COMPUTING		
Global Sequence Alignment	Compute the similarity between two DNA sequences.	dynamic programming, strings
Particle Collision Simulation	Simulate the motion of N colliding particles according to the laws of elastic collision.	priority queue, event- driven simulation
Root Finding	Compute square roots using Newton's method.	loops, numerical computation
Cracking the Genetic Codes	Find the genetic encoding of amino acids, given a protein and a genetic sequence known to contain that protein.	strings, file input
COMBINATORIAL OPTIMIZATION		
Traveling Sales person Problem	Find the shortest route connecting 13,509 Indian cities.	linked list, heuristics
TEXT PROCESSING		
Word Searching	Search for words horizontally, vertically and diagonally in a 2D character array	tries
Redundancy Detector	Find the longest repeated sequence in a given text.	suffix sorting, strings
Text Indexing	Build an inverted index of a text corpus and find the position of query strings in the text	suffix sorting or binary search tree

COMMUNICATION		
Prefix Free Codes	Decode a message compressed using Huffman codes.	binary trees, data compression
Burrows-Wheeler	Implement a novel text compression scheme tha out-compresses PKZIP.	suffix sorting, arrays, data compression
RSA Cryptosystem	Implement the RSA cryptosystem.	big integers, repeated squaring, analysis of algorithms
DISCRETE MATH		
Linked List Sort	Shell sort a linked list.	linked list, shell sort
Factoring	Factor large integers-using Pollard's rho method.	big integers, Euclid's algorithm
Deques and Randomized Queues	Create deque and randomized queue ADTs.	abstract data types, generics
Stock Market	Predict the performance of a stock using Dilbert'srule.	loops

Lab Experiments

Si No.	Experiment Problem Statement
1	The sieve of Eratosthenes is one of the most efficient ways to find all primes smaller than n when n is smaller than 10 million .Given a number n, use JAVA to print all primes smaller than or equal to n.
2	The Gauss-Jordan method is also known as Gauss-Jordan elimination method is very useful in solving a linear system of equations. It is a technique in which a system of linear equations is resolved by the means of matrices. Develop a JAVA program to solve a given set of linear equations.

3	To compute a square root of any positive number a,start with an initial guess $x = x_1$for $\sqrt{a}$; we then calculate successive approximations using the formula: $x_i = \frac{x_{i-1} + (a/x_{i-1})}{2}, i = 2, 3, \ldots x_2, x_3 \ldots, \sqrt{a}$ Develop a JAVA application that implements the above $SQRT$function to compute the square root of any positive number
4	Model a lamp as a Java object. Make a Lamp class. This will contain at least one instance variable which will be of type Boolean and will hold the state of the lamp :i.e.,whether it is on or off. In addition, add methods to do the following things: switch the light on and off, and check its current state, i.e., whether it is on or off. Maintain proper encapsulation mechanism. Next, write a launcher class with a main() method to carry out the following tasks: create a lamp object; turn it on and off; Print the lamp's on/off status to the console.

5	Given the following functional interface:
	
	interface Math Operation {
	
	int operation(int a, int b);
	
	}
	
	Develop an application that would implement the above interface using lambda expressions as to perform the addition, subtraction, multiplication and division operations.

6	The String class in JAVA has a static method compare To Ignore Case, which compares two strings and the Arrays class has a static sort method. Build a JAVA program that creates an array of strings, use the sort function from Arrays class to sort the strings by passing the compare To Ignore Case function as a parameter to the sort function using method reference.Print the sorted array.

7	XYZ technologies is firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize it spay roll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. income Tax is 40% of gross salary for all employees. Theannual increments to the employees are to be given of the following criteria: -Manager10%of the basic salary, and Technicians15%of basic.Develop the payroll for XYZ. Implement a class hierarchy using in heritance,where Employee is an abstract class and Manager and Technician are derived from Employee. Demonstrate a polymorphic behavior for giving the annual increments.
8	Define a new Exception class named Odd Exception.Create a new class named Even Odd. Write a method called half Of(), which takes as parameter and throws an Odd Exception if the intisoddor zero,otherwise returns(int/2).Write a main method that calls half Of() three times (once each with an even int, an odd int, and zero), with three try/catch blocks, and prints either the output of half Of() or the caught Odd Exception.
9	Implement a class named Fraction that represents fractions with numerator and denominator always stored reduced to lowest terms. If fraction is negative, the numerator will always be negative, and all operations leave results stored in lowest terms. Implement the addition, subtraction, multiplication and division operation for the Fraction class and also handle divide by zero using java exception handling mechanism.
10	Create a class Student that has instance variables as Name, Age, Address and access or and mutilator methods to access the instance variables along with display method to print the details of student. Next write a main() function that will create a collection of 10 students and reverse the list. Print the details before and after reversing the collection.
11	Use generics to build a class Sort. Implement the bubble sort algorithm to sort an array of any type.
12	Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).

B18CS3040	Data Structures	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for Problem Solving (B18CS1030)

Course Description:

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

Course Objectives:

1. Explain the basic Concepts of java and Data Structures
2. Illustrate the creation and use of singly and doubly Linked list in Java.
3. Demonstrate the use of Stacks and Queues in real world applications.
4. Discuss the concept and applications of Binary trees.

Course Outcomes (Cos):

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

CO1: Make use of Java Arrays to solve real world problems.

CO2: Develop a java program for implementing the linked list.

CO3: Build a real-world application in Java using stacks and queues.

CO4: Apply the concepts of trees for solving real world problems.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	3	2	-	-	-	-	-	-	3	3	-	-
CO 2	3	2	3	3	2	-	-	-	-	-	-	3	3	3	-

CO 3	3	1	2	3	1	-	-	-	-	-	-	3	3	3	-
CO 4	3	1	3	3	2	-	-	-	-	-	-	3	3	3	-

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

Course Content:

UNIT1

Introduction to java: base types, "hello universe" java program, classes and objects, Strings, Wrappers, Arrays and Enum types, type conversion

Fundamental Data Structure: Arrays – definition, sorting an array- insertion sort, java methods for array operations, random number generation

UNIT 2

Linked list: Singly linked list definition, illustration- insert and deleting at beginning and end of list, implementation in java. Circular linked list – implementation in java; Doubly linked list- illustration of insertions and deletions.

Application: Round robin scheduling using linked list.

UNIT 3

Stacks: definition, stack ADT, Array implementation of stack, linked list implementation, implementation of stack class in java.

Application: java implementation for reversing an array using stack; illustration of infix to post fix conversion, evaluation of post fix expression.

Queue: definition, Queue ADT, array implementation, linked list implementation

Application: printer job assigning using circular queue

UNIT 4

Trees : general trees- definitions and properties; Binary Tree ADT, Binary Tree properties, Binary Tree interface in java, Abstract Binary Tree base class in java, linked list representation of Binary Tree, Java implementation of linked binary tree structure.

Application: Tree traversal – illustration of preorder, post order traversal.

Self Learning Component:

Storing game entities in a array, Pseudo-random number generators, reversing an array using a stack, Matching parentheses and HTML tags, Double ended queue, application of tree traversals

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithmsin n JAVA , Wiley, 6th Edition, 20l4

2. Herbert Schildt, The Complete reference Java, 7thedition, 2007

REFERENCE BOOKS:

1. Richard Gilberg, Behrouz Forouzan, "Data Structures: A Pseudocode Approach with C", language Learning,2004.

2. Debasis Samanta, "Classic Data Structures", second edition, PHI Learning Private Limited,20ll.

B18CS3050	Discrete Mathematics	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Multi-variable calculus and linear algebra [B18CS1010], Probability and Statistics [B18CS2010]

Course Description:

A course designed to prepare math, computer science and engineering majors for a background in abstraction, notation and critical thinking for the mathematics most directly related to computer science. Topics include: logic, relations, functions, basic set theory, count ability and counting arguments, proof techniques, mathematical induction, graph theory, combinatorics, discrete probability, recursion, recurrence relations, elementary number theory.

Course Objectives:

1. Explain the strategies for potential proofs in logical sequential order without mathematical symbols (plain English).
2. Demonstrate how to carry out the operations on discrete structures such as sets, relations and functions.
3. Illustrate the use of Algebraic structures and how to carry out operations on them.
4. Discuss the concepts of Lattices and boolean algebra

Course Outcomes (Cos):

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

CO1: Identify the mathematical problems in the field of engineering science (AI) and obtain the solution for the same and draw conclusions from facts, using logical gates designing the chips used for CPU's and other critical components of digital drives

CO2: Formulate problems and solve recurrence relations also apply knowledge of pigeon hole principle to solve real time problems.

CO3: Apply group theory to reduce multiplicative complexity to creation of digital holograms (Engineering Science), also apply knowledge of group theory in the field general science as a kind of abstract mathematical tool.

CO4: Make use of the Ideas of lattice theory in implementation of knowledge representation language and use of Boolean algebra in modelling and simplifying switching circuits

CO, PO & PSO MAPPING:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-

CO2	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-

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

Course Contents:

UNIT-1: Set Theory & Logic

Set theory fundamental operations; propositions; negation; disjunction and conjuction; implication and equivalence; truth tables; laws of Logic; predicates; quantifiers; rules of Inference; methods of proofs;

UNIT-2 : Relations

Relations; representation of relations by graphs; properties of relations; equivalence relations and partitions; Equivalence Classes

UNIT-3 : Functions

Functions; mappings; injection and surjections; composition of functions; inverse functions; pigeon hole principle; Stirling Numbers

UNIT-4 : Lattices and boolean algebra

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices –Boolean algebra.

Self-learning component:

Function Composition and Inverse Functions, Equivalence Relations and Partitions, Method of generating functions. Application of concepts to Data mining techniques like Classification, Association, Clustering, Regression Analysis.

TEXT BOOKS:

1. Kenneth H Rosen, Discrete mathematics and its application, McGraw Hill, Sept. 2002

2. Englewood cliffs, Graph theory and its applications tp Engineering and computer science, Prentice Hall, 1974.

REFERENCE BOOKS:

1. V. Krishnamurthy, Combinatorics: Theory and Applications, East-West Press Pt. Ltd., Delhi, 1986.

2. J. Tremble, Manohar, Discrete Mathematical Structures with applications to computer Science McGraw Hill pub. 1975.

3. Richard Kohar, Basic Discrete Mathematics: Logic, Set Theory, and Probability, World Scientific Publishing Company, 1st Edition, 2017

4. Oscar Levin, Discrete mathematics: An Open Introduction, CreateSpace Independent Publishing Platform, 2nd edition, 2016

B18CS3060	Software Engineering	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Any Programming language

CourseDescription:

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

CourseObjectives:

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

Course Outcomes:

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

CO1: Apply software development process to solve complex problems of engineering.

CO2: Make use of Agile principle for rapid software development.

CO3: Distinguish between the traditional SDLC and agile ALM model for efficient and effective product delivery.

CO4: Develop the real-world applications using DevOps tools.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO 2	3	-	3	-	-	-	-	-	-	-	-	-	-	-	3
CO 3	3	-	3		3	-	-	-	-	-	-	-	3	-	-

CO 4	3	-	3	-	3	-	-	-	-	-	-	-	-	3	3

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

Course Content:

Unit-1

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

Unit- 2

Agile Application Lifecycle Management: Goals of Agile Application Lifecycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD? ,Focus on 12 Agile Principles, Agile Manifesto, Fixed Timebox Sprints, Customer Collaboration, Requirements, and Documentation.

Unit- 3

Automating the Agile ALM: Goals of Automating the Agile ALM, Why Automating the ALMIs Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus OpenSource, What Do I Do Today? Automating the Workflow, Process Modeling Automation, Managingthe Lifecycle with ALM, Broad Scope of ALM Tools, Achieving Seamless Integration, Managing Requirements of the ALM, Creating Epics and Stories, Systems and +Driven Development

Environment Management, Gold Copies, Supporting the CMDB, Driving DevOps, Supporting Operations, Help Desk, Service Desk, Incident Management, Problem Escalation, Project Management, Planning the PMO, Planning for Implementation, Evaluating and Selecting the Right Tools, Definingthe Use Case, TrainingIs Essential, Vendor Relationships, Keeping Tools Current.

Unit- 4

DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps inDev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA

and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous ProcessImprovement.

Self-learning component:

Case study on Critical system; Case study on ATM using agile method

TEXTBOOKS:

1. BobAiello and LeslieSachs, “Agile Application Lifecycle Management Using DevOps to Drive Process Improvement”, Addison Wesly, Firstprinting, June2016.

REFERENCE BOOKS:

1. RogerS, “Software Engineering-A Practitioner’s Approach”, seventh edition, Pressman, 2010.
2. Roger Pressman, Ian sommerville, “Software Engineering”, 9th edition,2010.
3. Hans Van Vliet, “Software Engineering: Principles and Practices”,2008.
4. Richard Fairley, “Software Engineering Concepts”,2008.
5. ACM Transactions on Software Engineering and Methodology (TOSEM).
6. IEEE Transactions on SoftwareEngineering.

B18CS3070	Data Structures Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Knowledge of any programming Languages like JAVA

Course Description:

This course helps students to understand the fundamentals of Data structures concepts like stacks, queues, trees, lists etc. This is a core of data storage which is very vital in processing data in the primary memory. The course involves understanding and implementation of various data structure concepts.

Course Objectives:

1. Explain the fundamentals of arrays to develop simple programs.
2. Discuss data structures to solve problems like infix to postfix and similar kind.
3. Demonstrate structures to handle various sorting algorithms.
4. Illustrate lists and tree structures to develop applications

Course Outcomes:

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

CO1: Apply complex array operations on given 2D matrix to convert it to a sparse matrix.

CO2: Choose appropriate data-structures for converting infix expression to postfix expression.

CO3: Develop applications based on different data structures for sorting, searching and computing.

CO4: Utilize the linked list to implement tree structures.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3		1	1	-	-	-	3	3	-	1	3	3	3
CO 2	3	3	1	2	3	-	-	-	3	3	1	1	3	3	3

CO 3	**3**	**2**	**1**	**1**	**3**	**1**	**-**	**-**	**3**	**3**	**1**	**-**	**3**	**3**	**3**
CO 4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**

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

Sl.No.	**List of experiments**
1.	Write a Java program using the data structure arrays to multiply two given matrices of same order.
2.	Develop a program in java to read a **sparse matrix** of integer values in the 2D array format and convert the sparse matrix to *<row, column, value>* format and search for an element specified by the user. Print the result of the search appropriately.
3.	Write Java programs to implement the STACK ADT using an array.
4.	Write Java programs to implement the QUEUE ADT using an array.
5.	The compilers always convert infix expression into postfix to perform further operations like parsing, lexical analysis etc. Select an appropriate data structure and develop a program to convert an infix expression into postfix using **stack.**
6.	Write Java programs to implement the STACK ADT using a singly linked list.
7.	Evaluation of postfix expressions is done by compilers during the compilation process. Design and Develop a program to evaluate a postfix expression using **stack**.
8.	Write Java programs to implement the QUEUE ADT using a singly linked list.
9.	Write a java program that determines whether parenthetic symbols ( ), { } and [ ] are nested correctly in a string of characters (use stack ADT).
10.	Write a java program that uses both stack and queue to test whether the given string is a palindrome (Use Java Utility).
11.	Files are stored in memory in tree structure directory. Design and develop a program to create a directory having files with unique file-id in the hard disk and display the files in all three traversal orders using Binary Search Tree (BST).
12.	Consider a class having 100 students where, the details of each student like name, roll number and marks of 3 subjects is to be stored. Design and develop a program to construct a singly linked list to enter records of different students in list, display the list and calculate the percentage of each student. Also count the number of students passed (scored >40 in all the subjects).

B18CS3080	Logic Design and Analog Circuits Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Basic Electrical & Electronics Engineering B18CS1040

Course Description:

The course provides foundation on designing and implementation of logic circuits. Analog circuits will be simulated using ORCAD tool and digital circuits using XILINX tool which helps in gaining experience in creating and testing of circuits.

Course Objectives:

1. Explain behavior of sequential Digital logic circuits using hardware components.
2. Discuss different families of digital integrated circuits, build, and troubleshoot combinational circuits using digital integrated circuits.
3. Illustrate circuits for basic knowledge in solid state electronics including diodes, BJT, and operational amplifier.
4. Describe analog electronic circuits using discrete components and analyze its output.

Course Outcomes:

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

CO1: Examine behavior of sequential Digital logic circuits using hardware components.

CO2: Design different families of digital integrated circuits, build, and troubleshoot combinational circuits using digital integrated circuits.

CO3: Construct circuits for basic knowledge in solid state electronics including diodes, BJT, and operational amplifier.

CO4: Develop the ability to analyze and design analog electronic circuits using discrete components

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2						3	3			3	3	3
CO 2	3	2			2				3	3			3	3	3
CO 3	3	3			3				3	3			3	3	3

CO 4	3	3							3	3			3	3	3

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

List of experiment

Sl. No.		Experiment
1	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
2	a	Given a 4-variable logic expression, simplify itusing Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC
	b	Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working
3	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. Simulate and verify its working
4	a	Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working
	b	Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
5	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 its working.
6		To build and simulate CE amplifier (RC coupled amplifier) for its frequency response and measure the bandwidth.

7		To simulate a rectangular wave form generator (Op-amp relaxation oscillator) and compare the frequency and duty cycle with the design specifications
8		To simulate a positive clipper, double ended clipper & positive clamper circuits using diodes
9		To simulate a Wien bridge Oscillator
10		To determine the working of a power supply and observe the waveforms
11		To determine the working of a Waveform Generators/Converters and observe thewaveforms
12		To simulate a Schmitt trigger using Op-amp and compare the UTP and LTP values with the given specification

IV Semester
Syllabus

B18CS4010	Design and Analysis of Algorithm	L	T	P	C
Duration:14Wks		3	0	1	4

Prerequisites:

Programming for Problem Solving (B18CS1030), Data Structures using Java (B18CS3040)

Course Description:

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

Course Objectives

The objectives of this course are to:

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

Course Outcomes (Cos):

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

CO1: Apply the knowledge of mathematical foundation for the analysis of algorithms.

CO2: Design and Develop the algorithms for the problems using brute force and divide and conquer design paradigm.

CO3: Build algorithms based on greedy and dynamic programming techniques.

CO4: Utilize backtracking and branch and bound techniques to solve the problems (TSP, Knapsack).

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	1	3	1	-	-	-	3	3	-	1	3	3	3
CO 2	2	2	1	2	2	-	-	-	3	3	-	2	3	3	3

CO 3	2	2	1	3	2	-	-	-	3	3	-	2	3	3	3
CO 4	2	1	1	3	2	-	-	-	3	3	-	1	3	3	3

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

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Course Contents:

UNIT- 1

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

UNIT -2

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

UNIT- 3

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

UNIT- 4

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

Self-learning component:

Decrease-and-Conquer: Algorithms for Generating Combinatorial Objects, Divide-and-Conquer: Strassen's Matrix Multiplication, Space and Time Trade-Offs: Hashing, Greedy Technique: Knapsack Problem, Huffman Trees and Codes, Coping with the Limitations of Algorithm Power: Hamiltonian Circuit Problem, Knapsack Problem

TEXT BOOKS:

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

2. Ellis Horowitz, Satraj Sahni and Rajasekaran, Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.

3. Kleinberg, Algorithm Design, Pearson Education, 1st Edition, 2013.

4. Michael Goodrich, Roberto Tamassia, Algorithm Design and Applications, Wiley Publishers, 1st Edition, 2014.

REFERENCE BOOKS:

1.Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, Introduction to Algorithms, PHI, 3rd Edition,

2.The design and analysis of computer algorithms, 4th Edition Addison-Wesley

3. ACM Transactions on Algorithms.

4.ACM Journal of Algorithms and Computational Technology.

Lab Experiments:

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

B18CS4020	Graph Theory	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Discrete Mathematics (B18CS3050)

Course Description:

Graph theory is the core content of Discrete Mathematics, and Discrete Mathematics is the theoretical basis of computer science and network information science. This course will cover the fundamental concepts of Graph Theory: simple graphs, digraphs, Eulerian and Hamiltonian graphs, trees, matchings, networks, paths and cycles, graph coloring, and planar graphs. There is an emphasis on applications to real world problems and on graph algorithms such as those for spanning trees, shortest paths, and network flows.

Course Objectives

The objectives of this course are to:

1. Explain induced subgraphs, cliques, matchings and covers in graphs
2. Illustrate the different types of graphs viz. Hamiltonian and/or Eulerian
3. Discuss problems involving Trees and its applications
4. Demonstrate algorithmic steps using graph theory in solving real world problems.

Course Outcomes (Cos):

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

CO1: Define different graphs and identify the isomorphism between the graphs.

CO2: Identify the Euler trail /circuit, Hamiltonian path/cycle and the max flow between the vertices in a given network problem

CO3: Illustrate different tresses, search traversals and matrix representation of a graphs.

CO4: Identify an appropriate algorithm to find the shortest path, spanning tree, connectedness and components of a connected graph.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	2	2	1	-	-	-	-	-	-	-	-	-	3	-	-

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

Course Contents:

UNIT-1:

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. Computer science applications.

UNIT-2:

Eulerian and Hamiltonian Graph and Graph coloring: Operation on graphs, Definition of EulerTrail, 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. Computer science applications.

UNIT-3:

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. Computer science applications.

UNIT-4:

Algorithms: Introduction, Algorithm efficiency, Inorder and Post Order Algorithms, Minimalspanning 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). Computer science applications.

Self-learning component:

Explore Algorithms on Graphs and Network Flows. Derivation of Time Complexities for advanced algorithms.

TEXT BOOKS:

1. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2014.

2. Ralph P Grimaldi, Discreteand Combinatorial mathematics, Pearson Education, 5th edition, 2014.

3. Douglas B, "Introduction to Graph Theory", Prentice Hall of India, 2nd edition, 2015.

REFERENCE BOOKS:

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. IEEE Journals and Magazines on Graph Theoy.

B18CS4030	Database Management System	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Discrete Mathematics (B18CS3050)

Course Description:

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

Course Objectives:

The objectives of this course are to:

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

Course Outcomes (Cos):

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

CO1 : Design conceptual entity relationship diagrams for the real-world applications.

CO2 : Make use of the concepts of relational algebra to solve queries over database.

CO3 : Construct the real-world database and solve queries over it using SQL commands.

CO4 : Develop an optimized database using design guidelines and normalization technique.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	2	-	-	-	-	1	-	1	3	3	-
CO 2	3	3	2	3	1	-	-	-	-	-	-	1	3	3	-
CO 3	3	3	2	3	3	-	-	-	-	-	-	1	3	3	3

CO 4	**3**	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**3**	**3**	**-**

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

Course Contents:

UNIT - 1

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

UNIT - 2

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

UNIT - 3

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

UNIT – 4

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

Self –Learning Components:

Sequences, synonyms, Triggers and Procedures and Introduction to Transaction Management Systems.

TEXT BOOKS:

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

4. Jeffrey A Hoffer, “Modern Database Management, Pearson”, 12th Edition, 2015

REFERENCE BOOKS:

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

B18CS4040	Computer Organization and Architecture	L	T	P	C
Duration:16 Wks		3	0	0	3

Prerequisites:

Basic electrical and Electronics [B18CS1040]

Course Description:

The course provides students with an understanding of the design of fundamental blocks used for building a computer system and interfacing techniques of these blocks to achieve different configurations of an "entire computer system". The course also gives introduction to multi core architecture and parallel programming.

Course Objectives:

The objectives of this course are to:

1. Explain the basics of arithmetic and logicaloperations
2. Demonstrate programs using instruction set of ARMprocessor
3. Illustrate performance trade off between different memory units and instruction sets
4. Discuss basics of parallelism and significance of multicore architecture.

Course Outcomes (Cos):

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

CO1 : Understand the arithmetic and logical operations

CO2 : Solve simple programming assignments using instruction set of ARM processor

CO3 : Distinguish performance trade off between different memory units and instruction sets

CO4 : Summarize the basics of computer hardware and how software interacts with computer hardware and also interpret parallelism, its applications, multicore architecture.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	-	3	-	2	-	-	-	-	-	-	-	3	3	3

CO 2	-	3	-	2	3	-	-	-	-	-	-	-	3	3	3
CO 3	2	-	-	3	3	-	-	-	-	-	-	-	3	3	3
CO 4	3	-	-		2	-	-	-	-	-	-	-	3	3	3

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

Course Contents:

Unit 1

Introduction to ARM processor: Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer, IOT, ARM Processor. ARM characteristics, register structure, Addressing modes, instructions, assembly language, Operating modes and Exceptions, Conditional execution of instructions

UNIT -2

Arithmetic unit: Addition and subtraction of signed numbers, Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations, arithmetic operations on floating point numbers.

UNIT- 3

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

UNIT- 4

Input/output Organization: Bus structure, Bus Operation, Arbitration, Interface Circuits, Intercommunication standards.

Parallel processing: Hardware multithreading, Vector (SMID) processing and shared memory multiprocessors.

Self-learning component:

More Recent Applications: Data-level parallelism-motivation, challenges, applications. Super Computing. Cluster based computing. Grid and cloud computing. RISC and CISC architecture.

TEXT BOOKS

1. Carl Hamacher ZvonkoVranesic, SafwatZaky, NaraigManjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Mcgraw HIll.
2. Linda Null, Julia Labor, the Essentials of Computer Organization and Architecture, Viva Publishers, 4th Edition, 2015.
3. William Stallings. “Computer organization and architecture: designing for performance”. Pearson Education India, 2000.

REFERENCE BOOKS

1. David A. Patterson, John L. Hennessy. “Computer organization and design: the Hardware/software interface”. Elsevier, 2011.

2. Peter Knaggs, “ARM Assembly Language Programming, April 2016.

B18CS4051	Signals and Systems	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Analog Electronic circuits [B18CS3020]

Course Description:

This course provides insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations. It introduces time domain representation of Linear Time invariant Systems such as Convolution Sum, Convolution Integral, differential equation and difference equations representation. It makes the students to understand the signal representation in Fourier domain such as Fourier transform, discrete time Fourier transform and Z-domain. It gives a brief insight into application of z-transform to solve impulse function of LTI systems etc.,

Course Objectives:

The objectives of this course are to:

1. Illustrate the operations on Signals, and the properties of Systems.
2. Explain Convolution operation on an LTI System.
3. Design conversion of signals between Time and Frequency domain using Fourier Transform.
4. Demonstrate the behavior of Causal LTI system using properties of Z-Transform.

Course Outcomes (Cos):

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

CO1: Make use of operations on Signals for processing the given signals.

CO2: Apply Convolution operation on an LTI System.

CO3: Develop Fourier Transformmethods to interconvert signal between Time and Frequency domain.

CO4: Analyse the behaviour of Causal LTI system using properties of Z-Transform.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-

CO 2	3	3	3	3	3	1	-	-	-	-	-	-	3	3	-
CO 3	3	3	3	2	2	1	1	-	-	-	-	-	3	3	-
CO 4	3	3	3	3	2	-	-	-	1	-	-	-	3	3	-

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

Course Content:

UNIT- 1:

Classification of Signals and Systems: Definition of a signals and system, Elementary signals, Basic operations on signals, Classification ofsignals.

UNIT- 2:

Analysis of Linear Time Invariant Systems:

Properties of systems, Time domain representation of LTI system: Impulse response representation, convolution sum, convolution integral, Block diagram representation.

UNIT-3:

Fourier Representation for signals: Continuous time Fourier series, discrete time Fourier series, Discrete time Fourier Transform (Definitions Only) - Continuous time Fourier Transform and their properties, Inverse Fourier transform. Applications of Fourier representations:

Sampling theorem and Nyquist rate.

UNIT-4:

Z-Transform: Introduction, Z - transform, properties of ROC, properties of Z - transforms, Inversion of Z - Transform, Unilateral Z-Transform and its application to solve difference equations.

Self Learning components:

Transform Analysis of LTI systems, Computational structures for implementing Discrete- Time systems, Laplace transform.

TEXT BOOKS:

1. Simon Haykins, “Signalsandsystems”, John Wiley, India Pvt Ltd, Second Edition,2008.
2. Michael Roberts, “Fundamentals of signals and systems”, TATA McGraw Hill,2nd Edition, 2010
3. Pierre Muret, Fundamentals of Electronics 2: Continuous-time signals and systems, Wiley, 1st Edition,20184. Willsky, Oppenheim, Signals and Systems, Pearson, 2ndEdition, 2015

REFERENCE BOOKS:

1. Allan V. Oppenheim, S. Wilsky and S.H. Nawab, “Signals and Systems”, Pearson Education, Second Edition, 1997.
2. Edward W Kamen & Bonnie’s Heck, “Fundamentals of Signals and Systems”, Pearson Education, Third Edition, 2007.

3. Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. “Signals & systems”,Pearson Education, Fourth Edition, 2003.

4. Ganesh Rao and SatishTunga, “Signals and Systems”, Pearson /Sanguine TechnicalPublishers, 2004

5. UdayKumar.S, “Signals and Systems”, Prism books Pvt.Ltd, 6th Edition2015

6. IEEE Transactions on Signal Processing.

B18CS4052	System Software	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Data Structures [B18CS3040].

Course Description:

The course provides the architecture of SIC and SIC/XE machine to build the concepts of System Software, function of various system software: assemblers; loaders and linkers, and macro processors.

Course Objectives:

The objectives of the course are to;

1. Explain basics of system software and differentiate between system software and application software.
2. Describe assemblers design (pass1 and pass2) for the SIC and SIC/XE machine architecture.
3. Illustrate the working of the pass1 and pass2 algorithms of linkers and loaders.
4. Discuss functions and algorithms of macro-processor.

Course Outcomes (Cos):

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

CO1: Make use of different instruction formats and addressing modes of SIC and SIC/XE architectures for implementing arithmetic operations.

CO2: Identify the suitable data structures required to develop various system software's.

CO3: Develop the programs for the pass1 and pass2 algorithms of linkers and loaders.

CO4: Apply functions and algorithms of macro-processor to process a given macro definition.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	1	2	2	1	-	-	-	-	-	1	3	-	-
CO 2	2	2	2	2	1	-	-	-	-	-	-	1	3	-	-

CO 3	**2**	**2**	**1**	**1**	**1**		**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**2**	**1**	**1**	**1**	**1**		**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

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

Course Content:

UNIT- 1:

Architecture of SIC; SIC\XE: Introduction: system software and machine architecture; Simplified Instructional Computer (SIC) – SIC; SIC/XE machine architecture; SIC and SIC/XE programming examples

UNIT- 2:

Assemblers: Basic assembler function; a simple SIC assembler; assembler algorithm and data structures; machine dependent assembler features - instruction formats; machine independent assembler features – literals symbol definition statements; expression; program blocks; control sections and programming linking

UNIT- 3:

Loaders and Linkers: Basic loader functions; design of an absolute loader; a simple bootstrap loader; machine-dependent loader features –relocation; program linking; algorithm and data structures for a linking loader; machine-independent loader features - automatic library search; loader options

UNIT- 4:

Macro Processor: Basic macro processor functions; macro definitions and expansion; macro processor algorithm and data structures; machine- independent macro processor features - concatenation of macro parameters; generation of unique labels; conditional macro expansion; keyword macro parameters

Self Learning Components:

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

1. H. Dave, Compilers: Principles and Practice, Pearson, 1st Edition, 2012

2. Elsevier Journal of Systems and Software.

3. IEEE Transactions on Software Engineering

B18CS4053	Embedded Systems Design	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Digital Logic Design [B18CS3010]

Course Description:

Embedded systems have become the next inevitable wave of technology, finding application in diverse fields of engineering. Microprocessors, together with sensors and actuators, have become embeddable in almost everything. The purpose of the course is to provide the students with the basic information about embedded systems which can be defined as a control system or computer system designed to perform a specific task.

Course Objectives:

The objectives of this course areto:

1. Demonstrate the optimal composition and characteristics of an embedded system.

2.Provide an understanding of the A/D conversion process.

3.Demonstrate the protocols and software tools employed In embedded system design.

4.Discuss Hardware/Software co-design techniques for micro controller-based embedded systems.

Course Outcomes (Cos):

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

CO1: Identify the optimal composition and characteristics of an embedded system

CO2: Analyze and discover the motives and caused of using sensors and actuators

CO3: Examine the protocols and software tools employed in embedded system design.

CO4: Compare the knowledge of Hardware/Software co-design techniques for microcontroller- based embedded systems.

CO, PO & PSO MAPPING:

COURSE OUTCOME	PROGRAM OUTCOMES														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	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 Content:

UNIT- 1

Introduction to Embedded Systems: Application Domain of Embedded Systems; Desirable Features and General Characteristics of Embedded Systems; Model of an Embedded System;

Microprocessor vs Microcontroller; Example of a Simple Embedded System; Figures ofMerit for an Embedded System; Classification of MCUs: 4/8/16/32Bits. Embedded Systems - The Hardware Point of View: Microcontroller Unit (MCU); A Popular 8-bit MCU; Memory for Embedded Systems; Low Power Design; Pullup and Pulldown Resistors.

UNIT -2

Sensors, ADCs and Actuators: Sensors; Analog to Digital Converters; Actuators.Examples of Embedded Systems: Mobile Phone; Automotive Electronics; Radio Frequency Identification (RIFD); Wireless Sensor Networks (WISENET); Robotics; Biomedical Applications; Brain Machine Interface.

UNIT- 3

Buses and Protocols: Defining Buses and Protocols; On-board Buses for Embedded Systems; External Buses; Automotive Buses; Wireless Communication Protocols. Software Development Tools: Embedded Program Development; Downloading the Hex File to the Non-volatile Memory; Hardware Simulator.

UNIT- 4

Real-time Operating Systems: Real-time Tasks; Real-time Systems; Types of Real-time Systems; Real-time Operating Systems (RTOS); Real-time Scheduling Algorithms; Rate Monotonic Algorithm; The Earliest Deadline First Algorithm; Qualities of a Good RTOS. Hardware Software Co-design and Embedded Product Development Lifecycle Management: Hardware Software Co-design; Modelling of Systems; Embedded Product Development Lifecycle Management; LifecycleModels.

Self-learning component:

Programming in Embedded C; ARM (Part 1: Architecture and Assembly Language Programming; Part 2: Peripheral Programming of ARM MCU Using C); PSoC-SoC for Embedded Applications; DSP Processors.

TEXT BOOKS:

1. Lyla B. Das, Embedded System: An Integrated Approach, Pearson, 2013

2. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press,2005.

3. Peter M, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and Internet of Things,

Springer, 3rd Edition,2018

4. RobToulson, Fast and Effective Systems Design, Newnes Publisher, 2nd Edition, 2016

REFERENCE BOOKS:

1. Frank Vahid, Tony D. Givargis, Embedded System Design- A Unified Hardware/Software Introduction, John Wiley,2002.

2. Jonathan W. Valvano, Embedded Microcomputer Systems, 3rd.edition, Cengage Learning, 2011.

3. David E. Simon, An Embedded Software Primer, Pearson Ed.,2005.

4. Raj Kamal, Introduction to Embedded Systems, TMH,2002.

5. Sri Ram VIyer, Pankaj Gupta, Embedded Real Time Systems Programming, TMH, 2004.

6. Michael Barr, Programming Embedded Systemsin C and C++, O'Reilly,1999.

7. International Journal of Embedded Systems-InderSciencePublishers.

B18CS4054	Operation Research	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Basic Mathematics, Linear Algebra (B18CS1010)

Course Description:

This course teaches a student the science of modelling and optimization. It provides tools and theories to solve these real-world problems by finding the optimal solutions to the models subject to constraints of time, labour, resource, material, and business rules. With Operations Research, people make intelligent decisions to develop and manage their processes and businesses.

Course Objectives:

The objectives of this course are to:

1. Explain basic concepts of Operation Research.
2. Illustrate a real-world problem as a linear programming problem
3. Discuss applications of dynamic programming and integer programming to solve an optimization problem.
4. Describe mathematical models based on game theory.

Course Outcomes (Cos):

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

CO1: Develop a mathematical model for a real-world decision-making problem using linear programming

CO2: Understand, formulate, and apply simplex algorithm to solve linear Transportation, Assignment problem and solve non-linear programming using search techniques.

CO3: Solve multi-stage decision problems into dynamic programming technique, solve Integer programming problems for optimization

CO4: Design and solve game theory problems to produce optimal decision making among competing players.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	2	-	-	-	-	-	-	-	1	-	3
CO 2	3	3	3	3	2	-	-	-	-	-	-	-	1	-	3
CO 3	3	3	3	3	2	-	-	-	-	-	-	-	1	-	3
CO 4	3	3	3	3	2	-	-	-	-	-	-	-	1	-	3

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

Course Contents:

UNIT-1

Introduction to Operations Research: Overview of Operations Research Modelling Approach, origin of operations research, nature of operations research, impact of operations research, defining a problem and gathering data, formulating a mathematical model, deriving solution from model, testing models, preparing to apply model, implementation, Introduction to optimization, Engineering Applications of Optimization, Statement of Optimization Problem.

UNIT-2

Linear and Non-Linear Programming: Linear Programming - Applications of linear programming, standard form of linear programming problem, solution of a system of linear simultaneous equations simplex algorithm, two phases of simplex method. Transportation problem, assignment problem

Non-Linear Programming - Unimodal function, unrestricted search – search with fixed step size, search with accelerated step size, Exhaustive search, random walk methods, Gradient of a function- evaluation of gradient, rate of change of a function along a direction, Transportation problem, assignment problem.

UNIT-3

Dynamic and Integer Programming: Dynamic Programming-Multistage decision process-definitionand examples, Concept of sub-optimisation and principle of optimality, computation procedure in dynamic programming, example illustrating calculus methods of solution, example illustrating tabular method of solution.

Integer Programming – Graphical representation, Gomory's cutting plane method-concept of a cutting plane, Gomory's method for integer programming problems, branch and bound methods.

Unit-4

Game Theory and Metaheuristics: Basic terminology – Player, Strategy, Optimal strategy, Payoff,Saddle point, Value of the game The formulation of two person, zero sum games, solving simple games- a prototype example, Pure Strategies (Minimax and Maximin Criterion)games with mixed strategies, graphical solution procedure, solving by linear programming.

Self-learning component:

Stochastic modelling and simulation, Metaheuristics.

TEXT BOOKS

1. Frederick S Hillier, Gerals J Lieberman, Bodhibrata Nag, PreetamBasu, Introduction to Operations Research, 9th Edition, McGraw Hill Education, Special Indian Edition, 2012.

2. Singiresu S Rao, Engineering Optimization Theory and Practice, 3rd Edition, New Age International, 3rd reprint, 2018.

3. K.V. Mittal, C. Mohan, Optimization Methods in Operations research and System Analysis, 3rd Edition New Age International Publishers, 1996.

REFERENCE BOOKS:

1. Frank Tillman, A Professional's guide to problem solving with decision science, Pioneering Partnership, 2nd Edition, 2018.

2. A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2016.

3. Hamdy A. Taha, Operations Research An Introduction, 8th Edition, Pearson Education, 2007.

4. IEEE Transactions on Evolutionary Computation.

B18CS4055	Numerical Techniques	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Multivariable Calculus and Linear Algebra [B18CS1010], Discrete Mathematics [B18CS3050]

Course Description:

This course emphasizes on the development of numerical algorithms to provide solutionsto common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand (1) the guaranteed accuracy that various methods provide, (2) the efficiency and scalability for large scale systems. and (3) issues of stability.

Course Objectives:

1. The objectives of this course are to: Explain numerical methods to obtain approximate solutions to mathematical problems.
2. Illustrate numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and non-linear equations, and the solution of differential equations.
3. Evaluate the accuracy of common numerical methods.
4. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

Course Outcomes (Cos):

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

CO1: Apply numerical methods to obtain approximate solutions for mathematical problems.

CO2: Make use of numerical methods for various mathematical operations.

CO3: Analyse the performance of common numerical methods.

CO4: Solve the real-world problems using differential equations, Euler's and Runge-Kutta methods

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2		2	-	-	-	-	-	-	1	1	-
CO2	2	2	2	3	2	2	-	-	-	-	-	-	1	1	-
CO3	2	2	2	2	2	1	-	-	-	-	-	-	1	1	-
CO4	2	2	3	3	2	3	-	-	-	-	-	-	1	1	-

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

Course Content:

Unit 1:

Floating Point Numbers and Errors: Floating point representation of a number and their arithmetic operations, Errors and their analysis: Approximate Numbers, Significant Digits, Round Off error, Truncation error, Absolute error, Relative error. Numerical Solutions to Algebraic and Transcendental Equations: Bolzano's Bi section method, SimpleIteration method, Method of False Position: Regula FalsiMethod, Newton's method for simple and multiple roots, All method's convergence analysis and order of convergence.

UNIT 2:

Solution of Simultaneous Linear Algebraic Systems: Direct Methods: Gauss elimination method (with row pivoting) and Gauss Jordan method, Iterative methods: Jacobi and Gauss- Seidel iterative methods

UNIT 3:

Interpolation: Finite Differences: Forward Differences, Backward Differences, Central Differences, Gregory Newton's forward and backward interpolation, Gauss' forward and backward interpolation Lagrange interpolation formula.

UNIT 4:

Numericalintegration: Newton-Cote squadrature formulae: Trapezoidal and Simpson's rules

Differential Equations: Euler's and Runge-Kutta methods (up to fourth-order).

Self learning component:

Shooting techniques, Relaxation techniques, Richards on extrapolation, Least-squares approximation

TEXT BOOKS:

1. T. Veerarajan, T. Ramachandran, “Numerical Methods with Programs in C”, Tata McGraw-Hill Education, 2nd edition, 2006.

2. Curtis F. Gerald and Patrick O. Wheatley, “Applied Numerical Analysis”, Pearson,7thEdition, 2003.

3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation”, New Age International Publishers, 6th edition, 2012.

4. Daniel Di Pietro, Numerical Methods for PDEs, Springer, 1st Edition,2018.

5. Mateos, Alonso, Computational Mathematical Numerical Analysis and Applications, Springer, 1st Edition,2017

REFERENCE BOOKS:

1. Manish Goyal, “Computer Based Numerical and Statistical Techniques”, Infinity Science Press LLC, Laxmi Publication, 2007

2. Steven C. Chappra, “Numerical Methods for Engineers”, McGraw-Hill Higher Education; 7th edition, 2014

3. AttilaMate, Introduction to Numerical Analysis with C Programs “, 2014

4. SIAM Journal on numerical Analysis.

5. Elsevier Journal of Applied numerical Mathematics.

B18CS4060	Database Management System Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Data structures lab [B18CS3070]

Course Description:

The course provides an introduction to Database Management systems. The requirement of modern days is to have an automated system that manages, modifies and updates data accurately. This is achieved by a DBMS in robust, correct and non-redundant way. This lab aims at practicing and solving DDL, DML and DCL queries using MySQL for achieving the same.

Course Objectives:

1. Explain the basics constraints of relational model.
2. Demonstrate the relational model using MySQL by incorporating the basic constraints
3. Illustrate the use of DDL, DML and DCL commands in SQL.
4. Make use of the SQL commands to construct database for any real-world application.

Course Outcomes:

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

CO1 : Design database schema and entity relationship diagrams for any real world application.

CO2 : Develop database for the application.

CO3 : Formulate the database with data in it for the application.

CO4 : Construct queries for database using SQL commands for the application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	-	-	-	3	3	-	-	3	3	3

CO 2	**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**
CO 3	**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**
CO 4	**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**

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

List of Experiments:

Experiment Nos.	Programs
1	Consider the following schema for a Library Database: **BOOK(Book_id,Title, Publisher_Name,Pub_Year)** **BOOK_AUTHORS (Book_id, Author_Name)** **PUBLISHER (Name, Address, Phone)** **BOOK_COPIES(Book_id, Branch_id, No-of_Copies)** **BOOK_LENDING(Book_id,Branch_id,Card_No,Date_Out,Due_Date)** **LIBRARY_BRANCH (Branch_id, Branch_Name,Address)** 1. Write SQL queries to Retrieve details of all books in the library - id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulationoperation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simplequery. 5. Create a view of all books and its number of copies that are currently available in the Library.Queries
2	Consider the following schema for Order Database: **SALESMAN (Salesman_id, Name, City,Commision)** **CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)** **ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)**

	1. Write SQL queries to Count the customers with grades above Banglore's average 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities (using union operation) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000.All his orders must also be deleted.
3	Consider the schema for Movie Database: **ACTOR (Act_id, Act_Name, Act_Gender)** **DIRECTOR (Dir_id, Dir_Name, Dir_Phone)** **MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)** **MOVIE_CAST (Act_id, Mov_id, Role)** **RATING (Mov_id, Rev_Stars)** Write SQL queries to 1. List the titles of all movies directed by'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after2015 (use JOIN operation) 4. Find the title of movies and number of stars for each movie that has atleast one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	Consider the schema for College Database: **STUDENT (USN, SName, Address, Phone, Gender)** **SEMSEC (SSID, Sem, Sec)** **CLASS (USN, SSID)** **SUBJECT (Subcode, Title, Sem, Credits)** **IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)** Write SQL queries to 1. List all the student details studying in fourth semester 'C'section.

	2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test 1 marks of student USN'1BI15CS101' in all subjects. 4. Calculate the FinalI A (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the followingcriterion: • If FinalIA = 17 to 20 then CAT = 'Outstanding' • If FinalIA=12to16thenCAT='Average' • If FinalIA< 12 then CAT ='Weak'.Give these details only for 8th semester A, B, and C section students
5	Consider the schema for Company Database: **EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)** **DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)** **DLOCATION (DNo,DLoc)** **PROJECT (PNo, PName, PLocation, DNo)** **WORKS_ON (SSN, PNo, Hours)** Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department. 3. Retrieve the name of each employee who works on all the projects controlled by department number. 4. (use NOT EXISTS operator). For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

Recommended Learning Resources:

1. https://www.arduino.cc
2. Peter J Knaggs, “ARM Assembly Language Programming”,2016.
3. (http://www.rigwit.co.uk/ARMBook/ARMBook.pdf)

B18CS4070	ARM Microcontroller and IOT	L	T	P	C
Duration:14Wks		**0**	**0**	**2**	**2**

Prerequisites:

Computer Organization and Architecture [B18CS4040]

Course Description:

The course provides an introduction to ARM assembly programming and Arduino programming. It covers the fundamentals of assembly programming and students will be able execute simple to moderate programs. Arduino covers basic programming required for interfacing sensors, actuators and cloud.

Course Objectives:

1. To Explain how to write assembly language programs for the ARM microcontroller
2. To demonstrate how to Interface various environmental and human interfaces with ARM microcontrollers
3. To illustrate the use of modern system development tools in the design of a microcontroller-based system
4. To discuss the development of microcontroller-based embedded systems for real-world control applications

Course Outcomes:

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

CO1 : Construct assembly language programs for the ARM microcontroller

CO2 : Interface various environmental and human interfaces with ARM microcontrollers

CO3 : Use modern system development tools in the design of a microcontroller-based system

CO4 : Develop microcontroller-based embedded systems for real-world control applications

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3	-	-	-	-	-	-	-	-	-	-	3	3	3

CO 2	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**
CO 3	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**3**	**3**
CO 4	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

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

List of Experiments:

	PART-A (ARM Experiments)
1.	a) Write an assembly language program to realize the given expressions i)A=B+C-D ii)A=4A+B iii)X=3X+4Y+9Z Write an assembly language program to add two 64-bit numbers.
2.	Write an assembly language program to find average of N 32-bit numbers.
3.	Write an assembly language program to find number of occurrences of a number in a given list using linear search method.
4.	Write an assembly language program to count number of ones in a given 32-bit binary number.
5.	Write an assembly language program to find factorial of a given 32-bit number using procedure.
	PART-B (IoT Experiments)
1.	Design and construct a module to drive stepper motor clockwise and anti-clockwise using Arduino board to indicate that plant need to be watered by sensing its moisture level.
2.	Design and construct a module to interface LCD to display the temperature and moisture values using Arduino board.
3.	Design and construct a module to interface ultrasonic sensor to alert the obstacle (turn ON the buzzer) using Arduino board.
4.	Design and construct a module to drive stepper motor clockwise and anti-clockwise using Arduino board to indicate that there is a gas leakage by sensing it.
5.	Design and construct a module to interface light sensor to detect the darkness and switch ON the LED.

Recommended Learning Resources:

1. https://www.arduino.cc

2. Peter J Knaggs, “ARM Assembly Language Programming”,2016.

3. (http://www.rigwit.co.uk/ARMBook/ARMBook.pdf)

III Year Detailed Syllabus

V Semester
Syllabus

B18CS5010	Finite Automata and Formal Languages	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Discrete Mathematics (B18CS3050)

Course Description:

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

Course Objectives:

1. Explain the concepts of Deterministic and Non-Deterministic Automata.
2. Demonstrate the use of regular expressions for constructing DFA and NFA.
3. Illustrate the construction of context free grammar for a given data.
4. Describe computing Machine including PDA and Turing Machine

Course Outcomes (COs):

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

CO1 : Construct the Finite State Machine by applying the concepts of DFA and NFA.

CO2 : Make use of regular expressions for constructing DFA and NFA.

CO3 : Identify ambiguity in grammar and Construct CFG for the given language in normal forms.

CO4 : Apply the concepts of Push down Automata and Turing machine for a given language.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	O8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	-	1	3	3	-

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

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

Course Contents:

UNIT - 1:

Introduction to finite automata: Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata

UNIT - 2:

Regular Expressions, regular languages and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;

UNIT- 3:

Context free Grammars and Normal forms: Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.

UNIT- 4:

Push Down Automata and Turing Machine: Push down automata (PDA); Languages of a PDA; Deterministic PDA; Turing Machine.

Self-Learning:

Applications of Finite Automata and Applications of Regular Expressions.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B18CS5020	Python for Data Analysis	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Probability and Statistics [B18CS2010]

Course Description:

Python Is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data. Python is a very powerful programming language used for many different applications. Over time, the huge community around this open source language has created quite a few tools to efficiently work with Python. In recent years, a number of tools have been built specifically for data science. As a result, analyzing data with Python has never been easier exploration. This course is an introduction to the Python programming for analyzing data for students without prior programming experience.

Course Objectives:

The objectives of the course are to:

1. Discuss the basics of Python
2. Demonstrate the use of multi-dimensional arrays in NumPy
3. Describe how pythonpandas is used for data analysis, simple statistical analyses and data visualizations.
4. Illustrate the importing, exporting and pre-processing of the data inPython.

Course Outcomes (Cos):

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

CO1: Utilize Python Data Structures to solve real world problems.

CO2: Develop python program using Numpy Arrays to compute descriptive statistics

CO3: Design and Develop python program using Pandas to compute descriptive statistics

CO4: Apply data cleaning and preparation on datasets.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	O8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	2	3	-	-	-	-	-	-	-	3	3	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	2	2	3	3	-	-	-	-	-	-	-	3	3	3

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

Course content

Unit 1:

Preliminaries

What Kinds of Data? Why Python for Data Analysis? Essential Python Libraries, Installation and Setup, Community and Conferences, Python Language Basics, IPython, and Jupyter Notebooks, The Python Interpreter, IPython Basics: Running the IPython Shell, Running the Jupyter Notebook, Tab Completion, Introspection, The %run Command, Executing Code from the Clipboard, Terminal Keyboard Shortcuts, About Magic Commands, Matplotlib Integration, Python Language Basics: Language Semantics, Scalar Types, Control Flow

Built-in Data Structures, Functions, and Files: Data Structures and Sequences, Functions, Files and the Operating System: Bytes and Unicode with Files

Unit 2:

NumPy Basics: Arrays and Vectorized Computation

The NumPy ndarray: A Multidimensional Array Object:Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes

Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays: Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation

Unit 3

Getting Started with pandas

Introduction to pandas Data Structures: Series, DataFrame, Index Objects

Essential Functionality: Re-indexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics: Correlation and Covariance, Unique Values, Value Counts, and Membership

Unit 4

Data Loading, Storage, and File Formats, Data Cleaning and Preparation

Reading and Writing Data in Text Format: Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats: Data Cleaning and Preparation: Handling Missing Data: Filtering Out Missing Data, Filling In Missing Data

Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Permutation and Random Sampling, Computing Indicator/Dummy Variables

String Manipulation: String Object Methods, Regular Expressions, Vectorized String Functions in pandas

Self Learning Component:

Data Visualization: Plotting line graph, bar graph, Scatter Plot & box plot.

TEXT BOOKS

1. Wes Mc Kinney, “Python for Data Analysis”, Oreilly Publications, 2nd edition, 2019.

2. Kenneth A. Lambert,” Fundamentals of Python: First Programs (introduction to Programming)”, 2nd Edition, 2018.

REFERENCE BOOKS:

1. Mark Lutz, Learning Python, Oreilly, 5th edition, 2013.

2. Elsevier Journal on Data mining.

3. Springer Journal of Data Science and Analytics.

4. IEEE Journal on Data Mining.

5. IEEE Journal on Data Mining and Analytics.

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B18CS5030	Computer Networks	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for Problem Solving (B18CS1030), Computer Organization and Architecture (B18CS4040)

Course Description:

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

Course Objectives:

The main objectives of this course are:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication
2. Discuss the error detection & correction strategies for data transmission.
3. Design the connection establishment of network computing devices.
4. Illustrate the TCP, UDP protocols and explain Domain Name System.

Course Outcomes:

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

CO1: Outline the protocol stacks (OSI and TCP/IP) used for data communication.

CO2: Apply error detection & correction strategies for data transmission

CO3: Analyze the connection establishment of network computing devices.

CO4: Compare TCP, UDP protocols and explain Domain Name System.

CO, PO & PSO MAPPING:

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

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
CO 2	3	3	3	3	2	-	-	-	-	-	-	1	3	-	3
CO 3	3	3	3	3	2	-	-	-	-	-	-	2	3	-	3
CO 4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3

Course Contents:

UNIT – 1:

Introduction to Data Communication and Networking: Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols & Standards, Introduction to Network Tools- (WireShark, Packet Tracer, NS3, etc), 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, Physical Layer – Periodic Analog signals, Digital signals, Request bit rate, shanon capacity, performance, PCM, DM, Parallel transmission, serial transmission, ASK, FSK, PSK, QAM, AM, FM, PM.

UNIT – 2:

Coding: Line Coding and block coding. Multiplexing: FDM, WDM, TDM, FHSS, DSSS, and Transmission Media.

Error Detection and Correction: Introduction, cyclic Codes: Cyclic redundancy code generation for checksum. Frames, Packets, Data Link Protocols: HDLC, Point-to-Point Protocol.

MAC Protocols: classification of MAC protocols, Random access (ALOHA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token passing), Channelization Protocols (FDMA, TDMA, CDMA)

Introduction to Networking Devices: Digital Subscriber Line Modems, Cable Modems, Repeaters, Hubs, Bridges, Routers, and High layered switches, Gateways, Virtual LAN.

UNIT-3:

Standards: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet. IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism. Bluetooth Architecture.

Introduction to Wireless networks-Wifi, WiMAX, 4G, 5G, Satellite Networks, MPLS, VPN, ATM.

Network Layer: IPv4 addresses, IP Datagram format, ICMP Messages, Mobile IP, IPv6 addresses, IPv6 Packet Format, Transition from IPv4 to IPv6, Routing algorithms (Distance Vector, Link State and Path vector), Unicast Routing protocols(RIP, OSPF), Introduction to BGP, Introduction to Multicasting protocols, brief introduction to multicast protocols such DVMRP, MOSPF, PIM, IGMP.

UNIT-4:

Transport Layer: Introduction to GoBack-N, Selective repeat N, Piggybacking. Services and port numbers, User Datagram Protocol (UDP): UDP Segment, Transmission Control. Protocol (TCP): TCP Segment, TCP Connection Set up, Application of TCP and UDP. TCP flow control, TCP error control, TCP Congestion Control and options. Introduction to SCTP services and features.

Application Layer: Client server programming using UDP and TCP, Name/Address Mapping, DNS Message Format.

Self-Learning Component:

Remote Login. Protocols: TELNET Protocol and SSH Protocol. Electronic Mail (E-Mail), World Wide Web (WWW).

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Alberto Leon-Garcia and Indra idjaja: Communication Networks – Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw – Hill, 2004.
2. Andrew S. Tanenbaum: Computer Networks, 4th Edition, Pearson Education, 2005.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks- A system Approach, 5th Edition, Elsevier, 2012.
4. William Stallings: Data and Computer Communications, 10th Edition, Pearson Education, 2008.
5. Douglas E. Comer: Internetworking with TCP/IP Vol.1, 6th Edition, Pearson, 1995.
6. IEEE Transactions on Networking.
7. Elsevier Journal of Computer Networks
8. Springer Journal of communications and Information networks.

B18CS5040	Operating Systems	L	T	P	C
Duration:14 Wks		3	0	1	4

Prerequisites:

Programming for Problem Solving (B18CS1030), Computer Organization and Architecture (B18CS4040)

Course Description:

This course starts with a brief historical perspective of the evolution of operating system and then covers the major components of most of the operating systems. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for allowing resources (e.g., disks, networks, and processors) to be shared, providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer) and protecting individual programs from one another. Emphasis is given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping) and file systems.

Course Objectives:

The objectives of this course are to:

1. Discuss the history, basics and structure of Operating System.
2. Demonstrate the process and threading concepts.
3. Illustrate the different scheduling and deadlock techniques
4. Explain the physical, virtual memory management techniques and file structure of UNIX operating system.

Course Outcomes (Cos):

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

CO1 : Identify the major components and different services of Operating system

CO2 : Evaluate the performance of different CPU Scheduling algorithms for the given real world applications.

CO3 : Build applications to overcome synchronisation problems and to avoid deadlocks

CO4 : Compare and contrast physical and virtual memory management techniques and interpret the file systems concepts

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	1	2	-	1	-	-	-	3	3	-	-	3	3	3
CO 2	1	2	3	2	1	-	-	-	3	3	-	-	3	3	3
CO 3	1	2	3	3	1	-	-	-	3	3	-	-	3	3	3
CO 4	2	2	2	1	2	-	-	-	3	3	-	-	3	3	3

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

Course Contents :

UNIT – 1:

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.

UNIT – 2:

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-3:

Synchronization and Deadlock

Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization: The Bounded-Buffer Problem, The Readers–Writers Problem, The Dining-Philosophers Problem; Monitors.

Deadlock: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.

UNIT – 4:

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.

File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection.

Self-learning components:

Virtual machines and Introduction to Linux Operating System, Introduction to Distributed computing, Parallel computing, grid computing, cloud computing.

TEXT BOOKS:

1. *Abraham Silberschatz, Peter Bear Galvin, Greg Gagne, Operating System Principles, Wiley Asia Student Edition, 2009.*

2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India, seventh edition, 2011.

3. D. M. Dhamdhere; Operating Systems: A Concept-Based Approach; Tata McGraw-Hill, Third edition 2012.

REFERENCE BOOKS:

1. Frederic Magoules, Jie Pan, Kiat - An Tan, Abhinit Kumar, Introduction to Grid Computing, CRC Press, Second Edition, 2014

2. Andrew Tanenbaum & Albert Woodhull, Operating Systems: Design and Implementation. Prentice-Hall, Third edition, 2014.

List of Experiments

Sl.NO.	NAME OF THE EXPERIMENT
1.	A child process in computing is a process created by another process (the parent process). This technique pertains to multitasking 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.	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 waiting time and average turnaround time.
4.	To design and develop 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 and their CPU burst times, display/print the Gantt chart for Priority. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5.	Given the list of processes and their CPU burst 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 turnaround time.
6.	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).
7.	Banker's Algorithm is used for Deadlock Avoiding purpose. It is suitable to resource allocation system with multiple instances of each resource type. Implement Banker's Algorithm which finds whether the state is safe or not.
8.	The operating system manages the computer's memory. The OS allocates required memory for the 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).
11.	**Optional Lab Programs**
12.	Implement shared memory and semaphore concepts for inter process communication.
13.	Implement file organization strategies a) single level b) Two level c) Hierarchical
14.	Write a C program to simulate the concept of Dining-Philosopher's problem.

15.	Write programs using the following system calls of UNIX operating system: exec, getpid, exit, wait, close, stat, opendir, readdir.
16.	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit.
17.	Implement Memory management Scheme-II a) Segmentation Concept.
18.	Write a C program to simulate the First fit contiguous memory allocation technique.
19.	Write a C program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN.
20.	Design and develop a data recording system that receives data from LAN and records it in a file .Use threading and buffering & Synchronization Mechanisms.
21.	Write a program that demonstrates the usage of the shared resources using semaphores

B18CS5051	Object oriented Analysis and Design	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for Problem Solving [B18CS1030]

Course Description:

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

Course Objectives:

The objective of this course is to:

1. Explain the object-oriented models for developing large applications
2. Describe the classes and objects.
3. Demonstrate the use of various UML diagrams in real world applications.
4. Discuss different case studies that make use of OOAD concepts.

Course Outcomes (Cos):

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

CO1: Identify sutible object models for solving the given real world problems.

CO2: Create objects and classes for a given real world problem.

CO3: Design use-case and sequence diagrams for the given real world application.

CO4: Develop real world application using Object oriented approach.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	3	1	2	-	-	-	-	-	-	-	3	-	-
CO 2	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-

CO 3	2	3	3	2	3	-	-	-	-	-	-	-	3	3	-
CO 4	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT- 1

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

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

UNIT -2

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

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

UNIT- 3

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

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

Unit- 4

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

Self-learning components:

System Usability and Measuring User Satisfaction: Usability Testing, User Satisfaction Test, Analyzing User Satisfaction by Satisfaction Test Template, Developing Usability Test Plans and Test Cases.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Brett McLaughlin, Gary Pollice, David West, Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D, Oreilly MediaInc,2007.
2. Brahma Dathan, Sarnath Ramnath, Object-Oriented Analysis, Design and Implementation: An Integrated Approach, Springer Universities Press,2015.
3. James J. Odell, Advanced Object-Oriented Analysis and Design Using UML, SIGS Books and Mutimedia,1998.
4. Elsevier Journal of systems andsoftware.
5. Springer Journal of Object-Oriented Programming.

B18CS5052	IoT Programming and Applications	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for Problem Solving. [B18CS1030]

Course Description:

The course covers the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. This course will get to know how to make design trade-offs between hardware and software. It also covers key components of networking to ensure that students understand how to connect their device to theInternet.

Course Objectives

The objectives of this course are to:

1. Explain basics of Arduinoprograms.
2. Illustrate sample programs to interface sensors to aurdino board storead, process and analyze data.
3. Demonstrate WebApp storead and stored at a from sensors, and to monitor and control IoTdevices.
4. Discuss IoT programming to develop larger smart products useful for thesociety.

Course Outcomes (Cos):

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

CO1: Develop programs to interface sensors to Aurdino board stored, process and analyze data.

CO2: Analyse the performance of Communication Protocols used in real time IoT Projects.

CO3: Make use ofdifferent IoT Patterns to develop the real worldapplications.

CO4: Identify the IoTsecurityrequirmentsto solve the given real-world problem.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	2	3	-	-	-		-	-	-	3	-	-
CO 2	2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	3	2	2	3	-	-	-	-	-	-	-	3	3	-
CO 4	2	3	3	3	3	-	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT- 1

Building Blocks: Arduino Basics, Hardware Requirements, Software Requirements: Toolbar, Status Window, Serial Monitor Window; Arduino Programming Language Reference Internet Connectivity: Arduino UnoWired Connectivity (Ethernet), Hardware Required, Software Required Circuit, Code (Arduino), Final Product; Arduino Uno Wireless Connectivity (WiFi), Hardware Required, Software Required, Circuit, Code (Arduino), FinalProduct

Communication Protocols: HTTP: Code (Arduino), Final Product; MQTT: Intrusion Detection System, Remote Lighting Control, Code (Arduino), Final Product

UNIT -2

Complex Flows: Node-RED: Hardware Required, Software Required, Circuit, Node-REDFlow, Code (Arduino), External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the Final Product.

IoT Patterns: Real-time Clients: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Code (Android): Project Setup, Screen Layout, Screen Logic, MQTT Client and the Final Product.

IoT Patterns: Remote Control: Hardware Required, Software Required, Circuit, Code (Android): Project Setup, Screen Layout, Screen Logic; MQTTClient, Code (Arduino):External Libraries, Internet Connectivity(Wireless) ,Data Subscribe, Control Lights, Standard Functions and the Final Product.

UNIT- 3

IoT Patterns: On-Demand Clients: Hardware Required, Software Required, Circuit, Database Table

(MySQL), Code (PHP): Database Connection, Receive and Store Sensor Data, Getthe Parking Spot Count; Code (Arduino):External Libraries, Internet Connectivity (Wireless), ReadSensor Data;Code (iOS): Project Setup, Screen Layout, Screen Logic and the Final Product.

IoT Patterns: Web Apps: Hardware Required, Software Required, Circuit, Database Table (MySQL), Code(PHP): Database Connection, Receive and Store Sensor Data, Dashboard; Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the Final Product.

IoT Patterns: Location Aware: Hardware Required, Software Required, Circuit, Database Table (MySQL), Code(PHP): Database Connection, Receive and Store Sensor Data, Map; Code (Arduino):External Libraries, Get GPSCoordinates, Data Publish, Standard Functions and the Final Product.

UNIT-4

IoT Patterns: Machine to Human: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Effektif Workflow: Process Creation, Process Configurations; Node-RED Flow and the Final Product.

IoT Patterns: Machine to Machine: Light Sensor Device, Code (Arduino): Lighting Control Device, Code (Arduino) and the Final Product

IoT Platforms: Hardware Required, Software Required, Circuit, Xively Setup, Zapier Setup, Xively Trigger, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the Final Product.

Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT -

Insufficient Authentication/Authorization - Insecure Access Control-Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities - Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption - Attack & Fault trees.

Self-learning component:

Explore any one of the boards like Raspberry Pi, Intel Galileo, Beagle Bone Black, Dragon Board, UDOO DUAL/QUAD, ARM Boards, DIY Development boards for IoT prototyping (C.H.I.P, MediatekLinkit One, Particle Photon, Tessel, Adafruit Flora, LightBlue Bean, Udoo Neo, Intel Edison)

TEXT BOOKS

1. Adeel Javed, Building Arduino Projects for the Internet of Things: Experiments with Real- World Applications, 2015, A press.
2. Brian Russell, Drew VanDuren, Practical Internet of Things Security (Kindle Edition), 2016

REFERENCE BOOKS:

1. AgusKurniawan, Smart Internet of Things Projects, Packt Publishing, 2016.

2. IEEE Internet of ThingsJournal.

3. Elsevier Journal of Internet of Things.

B18CS5053	Software Testing	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Software Engineering (B18CS3060)

Course Description:

This course examines fundamentals of twaretesting and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test case generation, test coverage, regression testing, program analysis (e.g., program-flow and data-flow analysis), and testprioritization

Course Objectives (Cos):

1. Discuss fundamental concepts in software testing.
2. Illustrate the use of different software testing methods.
3. Demonstrate the use of Selenium IDE to develop applications.
4. Discuss the use of locators in developing real world applications.

Course Outcomes (Cos):

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

CO1: Identify the fundamental concepts in software testing.

CO2: Analyse the performance of testing methods on the given real-world applications.

CO3: Develop an application using Software Testing IDE.

CO4: Make use of locators in developing real world applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-	-	-	3	-

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

CO3	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO4	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Course Content:

Unit1

Introduction: Software Testing Principles Need for testing, Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing, **Examples:** Generalized pseudocode, The triangle problem, The NextDate function, The commission problem. Introduction to Automated testing tools (open source and commercial)

Unit 2

Functional Testing: Boundary value analysis, Robustness testing, Equivalence Class Testing, Decision table method, **Examples:** The triangleproblem,

Structural Testing: Path Testing: DD-Paths, Test Coverage Metrics, Basis path Testing; Dataflow Testing: define/Use Testing, Slice Based Testing

Unit 3

Getting Started with Selenium IDE: Important preliminary points, what is Selenium IDE, installing Selenium IDE, Selenium IDE, Rules for automation, Recording your first test with Selenium IDE Updating a test to assert items are on the page, updating a test to verify items on the page adding Selenium IDE comments, multiplying windows, Working with multiple windows.

Unit 4

Locators: Locating elements by ID, Finding IDs of elements on the page with Firebug, finding elements by ID, Moving elements on the page, finding elements by name, Adding filters to the name, finding elements by link text. Overview of Selenium Web Driver, History of Selenium Architecture, Web Driver API, Web DriverSPI.

Self-learning component:

Automated Testing tools: QTP tools, Lab View etc, ATLM.

TEXT BOOKS:

1. P.C. Jorgensen, Software Testing A Craftman's Approach, CRC Press, by Auerbach Publication ISBN 9781466560680, October 18, 2013.

2. David Burns, Selenium 2 Testing Tools Beginner's Guide.

REFERENCE BOOKS:

1. Glenford J. Myers, The Art of Software Testing, John Wiley & Sons 1979 2. Boris Beizer, Black-Box Testing: Techniques for Functional Testing of Software and Systems, John Wiley & Sons 1995.

2. William E. Perry, Effective Methods for Software Testing (2nd Edition), JohnWiley & Sons 2000

3. Journal of Software Engineering and Research Engineering.

4. International Journal of Software Engineering, Technology and Applications

B18CS5054	Digital Communication	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Probability and Statistics [B18CS2010], Signals and Systems [B18CS4051]

Course Description:

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

Course Objectives (Cos)

The objectives of this course are to:

1: Demonstrate the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources

2: Discuss the flow and processing of information from the source to various units atthe transmitter side.

3: Illustrate the inverse operations at the receiver to facilitate the retrieval of transmitted information.

4: Describe various processing units of a digital communication system.

Course Outcomes (Cos):

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

CO1: Identify the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources

CO2: Analyze the flow and processing of information from the source to various units at the transmitter side.

CO3: Make use of the inverse operations at the receiver to facilitate the retrieval of transmitted information.

CO4: Apply the different Channel coding methods for the given real-world data.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	1	2	-	-	-	-	-	-	-	-	-	-	-

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

Course Content:

Unit- 1

Information Theory: Information and entropy, conditional entropy and redundancy, Shannon Fanocoding, Mutual Information, Information loss due to noise, source codings - Huffman Code, variable length coding, Source coding to Increase average Information per bit, Lossy source coding.

Unit -2

Digital Modulation Techniques: Introduction, ASK,ASK Modulator, Coherent ASK Detector, Non-Coherent ASK Detector, FSK, Bandwidth and Frequency Spectrum of FSK. Non coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, BPSK, Coherent PSK Detection, QPSK, Differential PSK.

Unit- 3

Spread Spectrum Modulation Techniques: Use of Spread Spectrum, Direct Sequence SpreadSpectrum (DSSS), Code Division Multiple Access, and Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems

Unit- 4

Channel coding: Waveform Coding, Types of Error control, Structured Sequences, Matrixdescription of Linear Block Codes, Error detection and error Correction capabilities of linear block codes, Cyclic Codes, Algebraic structure, encoding.

Self-Learning Component:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. John G. Proakis. Masoud Salehi, Digital Communications, 5th Edition, McGraw-Hill, 2008.
2. Simon Haykin, Digital Communication, John Wiley, 2005.
3. Ian A. Glover, Peter M. Grant, Digital Communications, Edition, Pearson Edu., 2008.
4. B.P. Lathi, Communication Systems, BS Publication, 2006.
5. Elsevier Journal Digital Communications and Networks.
6. IEEE Transactions on Communications.
7. Journal of Analog and Digital Communications.

B18CS5055	Microprocessors and Interfacing	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Digital Logic Design [B18CS3010]

Course Description:

The course describes the architecture, programming and interfacing of 8086 Microprocessor. It helps the student in building simple assembly language programs for 8086 Microprocessor. It also gives instruction to advanced microprocessors, GPUs and DSPs.

Course Objectives (Cos):

The objectives of this course are to:

1. Explain the architecture, pin configuration of various microprocessors and Interfacing ICs, Identify various addressing modes.
2. Illustrate 8086 assembly language Interrupt based real time applications.
3. Discuss 8086 programming for interfacing peripheral devices for control applications.
4. Describe the architecture of various advanced microprocessors.

Course Outcomes (Cos):

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

CO1: Identify the suitable addressing modes and instructions formats of 8086 architecture to develop program for the given real world problem.

CO2: Make use of addressing modes and instructions formats of 8086 architecture to develop assembly language programs for the given real-world problem.

CO3: Develop 8086 program to interface peripheral devices for control applications.

CO4: Compare the architecture of various advanced microprocessors.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	3	2	-	-	-	-	-	-	-	3	-	-
CO 2	3	2	3	3	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	1	2	3	1	-	-	-	-	-	-	-	3	3	-
CO 4	3	1	3	3	2	-	-	-	-	-	-	-	-	-	-

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

Course Content:

Unit -1:

Intel 8086 Microprocessor: Architecture of 8086, Register organization, Signal description, Physical memory organization, General bus operation, Input/output addressing capability, Special processor activities, Minimum and Maximum mode of 8086 system and timings.8086 Machine language Instructions: instruction formats, Addressing modes - Register, Immediate, Direct, Register indirect, Base plus index, Register relative and Base relative plus index addressing modes. Assembler directives -Symbols, variables, constants, different typesof directives, Introduction to IDE and MASMa Assembler Programming examples on debugging.

Unit -2:

Instruction Set Of 8086 Microprocessor: Data transfer instructions, Arithmetic and logical instructions, conditional and unconditional branch instructions, String instructions, Looping instructions, Machine control instructions, Shift and rotate instructions, Assembly language programming.

Introduction to stack, Stack structure of 8086, Interrupts and interrupt service routines, Interrupt cycle of 8086, Non-maskable interrupt, Maskable interrupt (INTR).Interrupt programming, Timing and delays, Macros.

Unit -3:

Peripherals And Their Interfacing With 8086: Static and dynamic RAM interfacing, Input and output ports Interfacing, Stepper motor Interfacing, Interfacing of Analog to digital converter and Digital to analog converter.

Programmable Input-Output Port 8255 (PPI): Modes of operation of 8255, Key board and display interfacing, Control of high power devices using 8255, programming examples.

Unit-4:

Introduction to Advanced Microprocessors: Introduction to Intel Microprocessors - 80186, 80286, 80386, 80486, Pentium, Pentium-II, Pentium-IV, Xeon. Overview of Architecture, Programming and Interfacing of these processors. Introduction to Kiel Software, Multicore programming, GPUs, SGX and DSP processors.

Self-learning component:

Coding and decoding of 8086 instructions set with some examples, Explore Complete Instructions set of 8086 Microprocessor in detail.

TEXT BOOKS:

1.A. K Ray and K.M. Bhurchandi, Advanced Microprocessor and Peripherals -Tata McGraw Hill, 2007.

2.K.R. Venugopal and Rajakumar, Microprocessor X86 Programming, BPB Publications, 2003.

REFERENCE BOOKS:

1. Yu Cheng Liu & Glenn A Gibson, Microcomputer systems 8086/8088 family, Architecture, Programming and Design -2nd Edition, Prentice Hall of India, July 2003.

2. Douglas V Hall, Microprocessor and Interfacing, Programming & Hardware, 2nd Edition, Penram International, 2006.

3. Barry. B. Bray, The Intel Microprocessor - 4th Edition, PHI, 1997.

4. Springer Lecture notes in Electrical engineering -Embedded Microcontroller Interfacing.

5. Elsevier Journal of Microprocessors and Interfacing.

B18CS5061	Unix System Programming	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Programming Problem solving [B18CS1030]

Course Objectives

Objectives of this course are to:

1. Discuss the UNIX, ANSI Standardsand POSIX API'S forfiles.
2. Describe the API's for implementing process control and to Identify System call interface for process management, multi tasking programs.
3. Demonstrate the use of Signals and Daemon processes inUNIX.
4. Explain different API's and IPCmethods.

Course Outcomes (COs)

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

CO1 : Make use of POSIX API'S to work with files.

CO2 : Apply the API's for implementing UNIX commands, process control and process management.

CO3 : Utilize Signals and Daemon processes in UNIX.

CO4 : Develop programs for message queues, FIFO programs and data transfer socket using appropriate API's, IPC methods and Sockets

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	3	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	1	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	3	1	-	-	-	-	-	-	-	3	3	-

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

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

Course Content

UNIT -1

UNIX System Overview, files & API's: UNIX system overview: UNIX architecture, logging in, files and directories, user identification, System calls and library functions.

UNIX File Types & API's: File types, File attributes, Application Program Interface to Files, Unix Kernel support for files, Directory files, Hard & symbolic links, API's: open, create, read, write, close, link, unlink.

UNIT - 2

UNIX Process and Relationships: Introduction, main function, process termination, command-line arguments, environment list, memory layout of C programs, UNIX kernel support for processes.

Process control: fork, vfork, exit, wait, waitpid, 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, Job Control, Execution of shell programs.

UNIT – 3

Signals & Daemon Processes: Signals: The UNIX Kernel Support for Signals, Signal Mask, sigaction (), The SIGCHLD Signal and the waitpid, Kill, Alarm, Interval Timers; Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

UNIT - 4

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.

File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, In odes in UNIX System, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

Self Learning component

OPENMP, OPENMPI, Sockets

TEXT BOOKS:

1. Unix System Programming Using C++, by Terrence Chan-Prentice Hall India,2011.
2. Advanced Programming in the UNIX Environment, by Stephen A. Rago, W. Richard Stevens, third edition, Pearson Education / PHI,2013.

REFERENCE BOOKS:

1. UNIX Systems Programming: Communication, Concurrency, and Threads by Kay A. Robbins and Steven Robbins, Prentice Hall; Second edition, December2015.
2. UNIX Network Programming, Inter process Communications (Paperback)(2nd Edition) by W. Richard Stevens, Addison-Wesley.

B18CS5062	Advanced DBMS	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Database Management System [B18CS4030]

Course Description:

Advanced database system deals with current and emerging technologies which enables to handle complex applications, provides a comprehensive understanding of data modelling techniques, OLAP, OLTP,Data warehouse and its practical implementation.

Course Objectives:

1. Discuss object-oriented concepts and object relational data bases.
2. Describe Parallel and distributed database.
3. Illustrate queries for distributed data storage and processing.
4. Explain enhanced data models for applications.

Course Outcomes (Cos):

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

CO1 : Identify the features of Object Definition Language and Object Query Language for given real world applications.

CO2 : Develop Complex queries in SQL and ODMG for parallel and distributed databases.

CO3 : Make use of different types of databases and other technologies to mine the data.

CO4 : Design multi dimension model for a given application in Data mining.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	-	-	-	-	-	-	3	-	-
CO2	3	3	2	3	2	2	-	-	-	-	-	-	-	3	-

CO3	**1**	**2**	**3**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO4	**3**	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

Unit- 1

Introduction to various tools and frameworks: Introduction to OLAP, OLTP and Data warehouse system, data modelling, star schema, snow flake schema. Build Data warehouse/data mart using opensource tools like pentaho data integration tool, pentaho business analytics. OLAP versus OLTP, Introduction to various tools Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.

Unit -2

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

Unit - 3

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases - Basic concepts

Unit - 4

Data Warehousing and Data Mining: Introduction to decision support, OLAP, multidimensional model, Window queries in SQL, Finding answers quickly, Implementation techniques for OLAP, Data Warehousing, Introduction to Data Mining, Counting co-occurrences, Mining for rules, Tree-structured rules, Clustering, Similarity search over sequences, Incremental mining and data streams;

Self-learning component:

More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management, P-P database, Transaction management.

TEXT BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw- Hill, 2003.

2. Elmasri and Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

3. Jiawei Han, MichelineKamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier, 2011.

REFERENCE BOOKS:

1. Connolly and Begg, Database Systems, 4th Edition, Pearson Education, 2002.

2. Journal of Data and Information Quality (JDIQ)

3. ACM Transactions on Knowledge Discovery from Data (TKDD)

4. ACM Transactions on Database Systems (TODS)

5. IEEE Transactions on Knowledge and Data Engineering

B18CS5063	Introduction to Robotics	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites

Multivariable Calculus and Linear Algebra [B18CS1010], Physics [B18CS2020]

Course Description

This course introduces techniques, algorithms and principles of interactive computer graphics and animation, this course also prepares for study in real-time rendering, realistic image Synthesis, and computer animation.

Course Objectives

1. Discuss the fundamental concepts of Robotics.
2. Explain intelligent module for robotic motion control.
3. Demonstrate robotic vision system using transformation techniques.
4. Illustrate the working of innovative robotic devices.

Course Outcomes (Cos)

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

CO1: Outline the fundamentals and architecture of robotics.

CO2: Design an Intelligent module for robotic motion control.

CO3: Develop robotic vision system using transformation techniques and sensors.

CO4: Make use of innovative robotic devices for industrial and socially relevant applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P O8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-

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

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

Course Contents:

Unit - 1

Introduction: Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot- Speed of Robot- Robot joints and links-Robot classifications-Architecture of robotic systems- Robot Drive systems-Hydraulic, Pneumatic and Electric system.

Unit -2

End effectors and robot controls: Mechanical grippers-Slider crank mechanism, Screw type, Rotaryactuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Illustration using ARDUINO Boards

Unit - 3

Robot transformations and sensors: Robot kinematics-Types- 2D, 3D Transformation-Scaling,Rotation, and Translation-Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors, Illustration using ARDUINO Boards

Unit - 4

Robot cell design and applications: Robot work cell design and control-Sequence control, Operatorinterface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot. Introduction to robotic operating system (ROS).

Self-learning component

MICRO/NANO ROBOTICS SYSTEM, MATLAB, NXT Software, Bio inspired Robots, Home automation Robots.

TEXT BOOKS:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012

REFERENCE BOOKS:

1. Richard D. Klafter, Thomas. A, ChriElewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning.,2009.

2. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.

3. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing Company Ltd., 1995

4. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.

5. Craig. J. J. Introduction to Robotics mechanics and control, Addison- Wesley, 1999.

6. Elsevier Journal of Robotics and autonomous systems

7. IEEE Journal on robotics and automation

B18CS5064	High Performance Computing	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Computer organization and architecture [B18CS4040], and Programming for Problem Solving [B18CS1030].

Course Description:

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

Course Objectives:

The objectives of this course are to:

1.Explain the features of Modern processors and parallel computers

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

3.Demonstrate the use of features of OpenMP programming.

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

Course Outcomes (Cos):

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

CO1: Identify different levels of parallelism that can be applied to solve the given real world problems**.**

CO2: Develop the programs using different levels of parallelism to solve the real-world problems.

CO3: Make use of features of OpenMP to develop parallel programs for solving real world problems.

CO4: Apply the features of Distributed-memory parallel programming with openMPI for solving real world problems.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	1	3	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	-	3	-
CO3	3	2	2	2	2	-	-	-	-	-	-	1	3	3	-
CO4	3	2	3	2	3	-	-		-	-		2	-	-	-

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

Course Content:

Unit- 1

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

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

Unit -2

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

Unit- 3

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

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

Unit- 4

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

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

Self-learning component:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Parallel Programming in OpenMP, Rohit Chandra, Leo Dagum, DrorMaydan, David Kohr, Jeff McDonald, Ramesh Menon.
2. Multi-core programming, Increase performance through software multiyhreading by Shameem Akhter and Jason Roberts 6. IEEE Transactions on Knowledge and Data Engineering.
3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw Hill 1993
4. George S. Almasi and Alan Gottlieb, Highly Parallel Computing.
5. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing, 2nd edition, Addison-Welsey, © 2003.

B18CS5065	Differential and Difference equations	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Multivariable Calculus and Linear Algebra [B18CS1010]

Course Description:

To study and understand the application approach of the conceptof differential equations arise from many problems in all modern scientific and engineering studies.Difference equations arise in the study of electrical networks, in the theory of probability, in statistical problems and many other fields of engineering.

Course Objectives (Cos)

The objectives of this course is to:

1. Explain first order and higher order Differential equations.
2. Illustrate homogenous and non-homogenous Partial Differential Equations.
3. Demonstrate the solving of Difference equations.
4. Discuss the applications of Z-Transforms in solving Difference equations.

Course Outcomes (Cos):

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

CO1: Solve first order and higher order Differential equations.

CO2: Distinguish between homogenous and non-homogenous Partial Differential Equations.

CO3: Make use of Difference equations in a given real time problems.

CO4: Choose the appropriatetheorem to solve the given real time applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	3	2	1	-	-	-	-	-	1	3	-	-

CO 2	**3**	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**-**
CO 3	**2**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**
CO 4	**3**	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

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

Course Content:

UNIT-1

Differential equations: Differential Equations of first order and first degree: Bernoulli's Equation,Exact equations and reducible to exact form (1. Close to expression M or N and find IF 2. y f(x) dx+x g(y) dy).

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

Applications:Newton's Law of cooling, Rate of Decay of radioactive problems.

UNIT-2

Partial Differential Equations: Formation of Partial differential equations, Solution of lagranges linear PDE, Solutions of non homogenous PDE by direct integration, Solution of homogenous PDE involving derivatives with respect to one independent variable, Solution of PDE by Product method .

UNIT-3

Difference Equations: Formation of Difference Equations -Linear Difference Equations- Rules for finding the complementary function and Particular Integral -Simultaneous Difference Equations with constant coefficients. Application to Deflection of a loaded string

UNIT-4

Z-Transforms: Definition- Properties-Shifting Properties-Multiplication by n-Initial value theorem, Final value theorem and problems-Convolution theorem-Inverse Z-Transforms. Application to Difference Equations by using Z-Transforms.

Self Learning Components:

Higher Order Linear equations, Boundary Value Problems

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42ndedition, 2013.

2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2012.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 1stedition, 2010.

2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", NarosaPublishingHouse, 4th edition, 2002.

B18CS5070	Statistical Data analysis Lab	L	T	P	C
Duration:14Wks		0	0	2	2

Prerequisites:

Probability and Statistics [B18CS2010]

Course Description:

This laboratory course enables students to practice different statistical techniques used in data analysis pipeline using Python. The data analysis ecosystem of Python is explored. Publicly available dataset will be downloaded for carrying outdifferent data cleaning techniques like normalization and standardization, calculation of summary statistics, numerical and string operations on statistics. The aim of this course is to enable a student to manipulate data by application of statistical methods and derive interesting relationships and regularities among elements of data. This course will also introduce visualization tools like matplotlib and seaborn in Python. Visualization of data often helps to get a better understanding of the data. The students are expected to know how to program in any programming language. Knowledge of linear algebra, probability and statistics is a prerequisite for this lab.

Course Objectives:

1. To write code for reading from various data sources and writing results back
2. To derive statistical measures from data
3. To apply regression and correlation operations on data
4. To generate plots from data

Course Outcomes:

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

CO1: Interpret statistical reasoning, modelling and limitations

CO2: Perform statistical analysis using tools and software

CO3: Demonstrate classification of datasets with supervised learning.

CO4: Build applications using PYTHON

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	2	-	-	-	3	3	-	-	3	3	3
CO2	2	2	2	2	2	1	-	-	3	3	-	1	3	3	3
CO3	2	2	2	2	2	1	-	-	3	3	-	1	3	3	3
CO4	2	2	2	2	2	1	-	-	3	3	-	1	3	3	3

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

List of Experiments:

Sample Data Set that can be used for programs – Boston Housing Dataset URL for Data set download- https://raw.githubusercontent.com/selva86/datasets/master/BostonHousing.csv

Description-

The Boston Housing Dataset is a derived from information collected by the U.S. Census Service concerning housing in the area of Boston MA. The dataset contains Housing Values in Suburbs of Boston. The “medv” variable is the target variable.

Data description

The Boston data frame has 506 rows and 14 columns.

This data frame contains the following columns:

- Crim -per capita crime rate by town.
- Zn- proportion of residential land zoned for lots over 25,000 sq.ft.
- Indus - proportion of non-retail business acres per town.
- Chas- Charles River dummy variable (= 1 if tract bounds river; 0 otherwise).
- Nox - nitrogen oxides concentration (parts per 10 million).
- Rm- average number of rooms per dwelling.
- Age- proportion of owner-occupied units built prior to 1940.
- Dis -weighted mean of distances to five Boston employment centres.

- Rad -index of accessibility to radial highways.
- Tax- full-value property-tax rate per \$10,000.
- Ptratio- pupil-teacher ratio by town.
- Black -1000(Bk - 0.63)^2 where Bk is the proportion of blacks by town.
- Lstat-lower status of the population (percent).
- Medv-median value of owner-occupied homes in \$1000s.

Source

1. Harrison, D. and Rubinfeld, D.L. (1978) Hedonic prices and the demand for clean air. J. Environ. Economics and Management 5, 81–102.
2. Belsley D.A., Kuh, E. and Welsch, R.E. (1980) Regression Diagnostics. Identifying Influential Data and Sources of Collinearity. New York: Wiley.

List of Programs:

Sl.No	Programs
	Anaconda is a free and open-source distribution of the Python and R programming languages for data science, machine learning applications, large-scale data processing, predictive analytics, etc.. Anaconda makes package management and deployment very simple. Download and Install of Anaconda Distribution of Python, understanding of Jupyter Notebook and various menu items in it, importing modules like Pandas, Numpy, SciPy etc.
1	Data frames in Python Pandas are excellent objects to handle tabular data from various sources. Write a python program to demonstrate creation of data frame using various formats of input data.
2	Any real time project involves data munging and data wrangling which involves selecting required rows and columns of data and manipulations on them. Write a python program to demonstrate following operations on rows and columns of a data frame: a. Selection b. Insertion

	Deletion
3	In order to explore the dataset and understand insights from it, the measures of central tendency play a crucial role, python has a strong set of functions that help you explore data. Write a python program to compute descriptive statistics for measures of central tendency from given data: - Mean, Geometric Mean, Harmonic Mean, Median, and Mode
4	Measuring descriptive statistics in data helps you decide what kind of processing to perform on it to gain useful information from data. Write a python program to compute descriptive Statistics for Measures of Variability from given data- Variance, Standard Deviation, Skew, Percentiles
5	Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. For example, height and weight are related; taller people tend to be heavier than shorter people. Write a python program to compute measures of Correlation in given data - using Pearson, Spearman correlation coefficients
6	Data Visualization is visually representing the data using different plots/graphs/charts to find out the pattern, outliers, and relation between different attributes of a dataset. It is a graphical representation of data that helps human eye to detect patterns in data hence helps give a direction to data analysis tasks. Write a python program to plot following graphs using Matplotlib – Scatter plot, Box Plot, Bar Chart, Pie Chart
7	Often a data analyst needs to combine data in a data frame by some criteria. This is done by providing a label to group data in the table. The pandas functions allow us to merge as well group data along rows and columns as per various criteria. Write a python program to demonstrate following operations on two data frames: a. Merging b. Group By
8	Hypothesis testing is a core concept in inferential statistics and a critical skill in the repertoire of a data scientist. The t-test is statistical hypothesis test in which the test

	statistic follows a student's t-distribution under the null hypothesis. It is applied for normally distributed test statistic. Write a python program to demonstrate Hypothesis testing using Student's T Test.
9	Regression is a technique for searching relationships among variables in data. E.g., trying to understand relationship between salary and experience in years for employees in a data set containing employee information. Linear regression involves relation between one dependent and one independent variable. Write a python program to apply simple linear regression on data
10	Multiple regression involves analysis of relation between one dependent and two or more independent variables. E.g., trying to establish relation between CGPA of a student as dependent on Attendance and SGPA. Write a python program to apply multiple linear regression on data
11	Ability to import specific columns and convert data types is often a powerful transformation that helps during data analysis. Demonstrate following on Boston Dataset - Import every 50th row of Boston Housing dataset as a DataFrame, then import the Boston housing dataset, but while importing change the 'medv' (median house value) column so that values < 25 becomes 'Low' and > 25 becomes 'High'.
12	Project -Data analysis aims to find interesting insights from the data. Using the Boston Housing Dataset, apply the learnt concepts of data summarization, visualization, correlation and regression to derive your own interesting insights from the data. The results of this program may vary from student to student.
Additional Programs	
13	Write a Python program to demonstrate basic operations on single array
14	Write a Python program to demonstrate following operations using numpy a. Addition and Subtraction

	b. Square root Transpose
15	Write a Python program to demonstrate horizontal and vertical stacking in Python
16	Write a Python program to plot heat map of a data set
17	Write a Python program to demonstrate conditional deletion of columns and addition of a new column to a data frame.
18	Write a Python program to demonstrate Classification operation on a dataset
19	Write a Python program to demonstrate K-Means clustering on a dataset
20	Write a Python program to demonstrate creation of a pandas DataFrame from various input formats.

B18CS5080	Computer Networks Lab	L	T	P	C
Duration :14Wks		0	0	2	2

Prerequisites:

Programming for Problem Solving [B18CS1030], Computer Organization and Architecture [B18CS4040]

Course Description:

The course description includes learning about computer network organization and implementation. This course provides knowledge of error detection and recovery, network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login. Protocols:.

Course Objectives:

The main objectives of this course are:

1. Describe the knowledge of the basic protocols involved in wired/wireless communication process.
2. Explain the key issues for the realization of errors detection and correction in Packets.
3. Discuss different network performance concepts and traffic issues for Quality of Service (QoS) in communication.
4. Illustrate concepts of classical computer and network security paradigms.

Course Outcomes:

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

CO1: Make use of the knowledge of the basic protocols involved in wired/wireless communication process.

CO2 : Identify the key issues for the realization of errors detection and correction in Packets.

CO3: Compare different network performance concepts and traffic issues for Quality of Service (QoS) in communication.

CO4: Assess concepts of classical computer and network security paradigms.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	-	-	2	-	-	-	-	-	2	-	3	3	3
CO 2	3	-	-	-	-	-	2	-	-	-	-	1	3	3	3

CO 3	**3**	**2**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**
CO 4	**3**	**2**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

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

Lab Experiments:

Sl.No.	Experiment Problem Statement
1	Introduction to: (a) discrete event simulation, (b) NS 3, (c) NS 3 Installation, (d) NetAnim.
2	Write a NS3 program to connect two nodes with a point to pint link, which have unique interface. Analyze the network performance using UDP client server.
3	Write a NS 3 program to demonstrate star topology and bus topology. Analyze the performance using UDP based applications.
4	Write a NS3 program to demonstrate hybrid topology of routers and nodes. Analyze the performance using UDP based applications.
5	Write a NS3 program to implement FTP using TCP bulk transfer, Analyze the performance.
6	Write a NS 3 program to create a simple dumbbell topology, two clients and two servers, two nodes forming bridges of the dumbbell. Use point to point links. Install UDP socket instance on one of the nodes of both sides of dumbbell. Analyze the network performance by clogging the bridge capacity from half to full.
7	Write NS 3 Program to configure two nodes on an 802.11b physical layer, with802.11b NICs in adhoc mode, and by default, sends one packet of 1000 (application) bytes to the other node. The physical layer is configured to receive at a fixed RSS (regardless of the distance and transmit power); therefore, changing position of the nodes has no effect. Analyze the performance.
8	Install wireshark, and analyze the packets using it on a selected interface. Apply filters and check the packets.
9	Install packet tracer, and consider a topology and configure VLAN.
10	Install NMAP, and execute atleast 10 commands to demonstrate the scanning of networks hosts and ports.

VI Semester
Syllabus

B19CS6010	Machine Learning for Data Analytics	L	T	P	C
Duration:14 Wks		3	0	1	4

Prerequisites:

Probability and Statistics [B19CS2010], Python for Data Analysis [B19CS5020]

Course Description:

The course introduces the fundamental concepts of machine learning, data exploration, information-based learning, similarity-based learning, probability-based learning, and error-based learning. It also discusses the art of machine learning for predictive data analytics and Descriptive Statistics& Data Visualization for Machine Learning.

Course Objectives

The objectives of this course is to:

1. Explain the characteristics of datasets and compare the trivial data and big data for various applications.
2. Illustrate implement machine learning techniques and computing environment that are suitable for the applications under consideration.
3. Describe various ways for implementation of selecting suitable model parameters for different machine learning techniques.
4. Discuss machine learning libraries and mathematical and statistical tools with modern technologies like Hadoop and MapReduce.

Course Outcomes (COs)

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

CO1 : Identify predictive data analytics tools to analyze the characteristics of datasets.

CO2 : Discuss and solve machine learning techniques for information-based learning

CO3 : Explain and use Bayesian network and regression techniques for suitable machine learning applications

CO 4 : Describe Statistics & Data Visualization for machine learning concepts.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3	3	3	2	2	-	-	3	3	-	-	3	3	3
CO 2	2	3	3	3	2	1	-	-	3	3	-	-	3	3	3
CO 3	3	3	2	3	2	1	-	-	3	3	-	-	3	3	3
CO 4	3	3	3	3	3	1	-	-	3	3	-	-	3	3	3

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

Course Content:

UNIT- 1

Machine Learning for Predictive Data Analytics: What is Predictive Data Analytics? What isMachine Learning? How does Machine Learning Work? What can go wrong with Machine Learning? The Predictive Data Analytics Project Life Cycle: CRISP-DM and Predictive Data Analytics Tools. Data to Insights to Decisions: Converting Business Problems into Analytics Solutions, Assessing Feasibility, Designing the Analytics Base Table and Designing & Implementing Features.

Data Exploration: The Data Quality Report, Getting to Know the Data, Identifying Data Quality Issues, Handling Data Quality Issues, Advanced Data Exploration and Data Preparation

UNIT- 2

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

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

UNIT- 3

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

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

Handling Categorical Target Features: Logistic Regression, Modelling Non-linear Relationships, Multinomial Logistic Regression and Support Vector Machines.

UNIT- 4

The Art of Machine Learning for Predictive Data Analytics: Different Perspectives on PredictionModels, Choosing a Machine Learning Approach, Matching Machine Learning Approaches to Projects Matching Machine Learning Approaches to Data and Your Next Steps.

Descriptive Statistics & Data Visualization for Machine Learning: Descriptive Statistics for Continuous Features, Central Tendency, Variation, Descriptive Statistics for Categorical Features, Populations & Samples.

Self-learning component:

Data Visualization, Bar Plots, Histograms and Box Plots.

TEXT BOOKS:

1. John D Kelleher, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics-Algorithms, Worked Examples and case studies", MIT Press, 2015.

REFERENCE BOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013.
2. EthemAlpaydin, Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd, 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer; 1st edition, 2001.
4. Springer Journal of Machine Learning.
5. International Journal of Machine Learning and Computing.

Lab Experiments (Project Based)

1. Write a python program to predict income levels of adult individuals using a linear regression model. The process includes training, testing and evaluating the model on the Adult dataset. In this sample experiment you need to train a classifier on the Adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
2. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets/master/adult-all.csv
3. Write a python code to cluster similar companies into same group given their Wikipedia articles and can be used to assign cluster to new company. The students are expected to demonstrate how to use the K-Means clustering

algorithm to perform segmentation on companies from the Standard Poor(S&P)500index, based on the text of Wikipedia articles About each company.

4. Refer the following link (S&P)500index: https://en.wikipedia.org/wiki/List_of_S%26P_500_companies
5. Write a python program to classify the medical dataset using Multilayer Perceptron Classifier. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
6. Refer the following link to download the Medical Data set:
7. https://lionbridge.ai/datasets/18-free-life-sciences-medical-datasets-for-machine-learning/
8. Write a python program to perform the prediction of retail sales. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
9. Refer the following link to download the Retail Sale Data set:
10. https://data.world/datasets/retail
11. Write a python code to predict the real estate sales price of a house based upon various quantitative features about the house and sale. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
12. Refer the following link to download the real estate sales price of a house Data set:
13. https://data.world/datasets/real-estate
14. Write a python program to predict income levels of adult individuals using Decision Tree Regression Model. The process includes training, testing and evaluating the model on the Adult dataset. In this sample experiment you need to train a classifier on the Adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
15. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets/master/adult-all.csv
16. Write a python program to predict income levels of adult individuals using Support Vector Machine Regression Model. The process includes training, testing and evaluating the model on the Adult dataset. In this sample experiment you need to train a classifier on the adult dataset, to predict whether an individual's income is greater or less than $50,000. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
17. Refer the following link to download the Adult Income Dataset: https://raw.githubusercontent.com/jbrownlee/Datasets/master/adult-all.csv

18. Write a python program to classify the medical dataset using Multilayer Perceptron Classifier. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
19. Refer the following link to download the Medical Data set:
20. https://lionbridge.ai/datasets/18-free-life-sciences-medical-datasets-for-machine-learning/
21. Write a python program to classify the medical dataset using Gaussian Naïve Bayes Classifier. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
22. Refer the following link to download the Medical Data set:
23. https://lionbridge.ai/datasets/18-free-life-sciences-medical-datasets-for-machine-learning/
24. Compare the performances of the classification models that you implemented to classify the medical dataset. The students are expected to demonstrate how you can perform basic data processing operations, split the dataset into training and test sets, train the model, score the test dataset, and evaluate the predictions.
25. Refer the following link to download the Medical Data set:
    https://lionbridge.ai/datasets/18-free-life-sciences-medical-datasets-for-machine-learning/

B18CS6020	Cloud Computing and Big Data	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites

Computer Networks [B18CS5030]

Course Description:

This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). It gives insight into various cloud infrastructure and management mechanisms. The introduction to Azure App Service and Web Apps isgiven.

Course Objectives:

The objectives of this course are to:

1. Discuss the various Cloud computing service models like Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
2. Explain the working of cloud computing technologies like data center technology, web technology, multitenant technology and service technology.
3. Illustrate the use of various cloud computing mechanisms like load balancer, automated scaled listener, failover system and more in real worldapplications.
4. Describe virtualization of application and resources in Cloud scenario.

Course Outcomes (COs):

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

CO1: Identify basic requirements related to cloud computing technologies.

CO2: Compare and contrast different layers of cloud computing viz. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

CO3: Make use of Cloud management mechanisms in solving real world problems.

CO4: Apply the Bigdata concepts in real world applications

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	3	3	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	3	3	3	2	-	-	-	-	-	-	-	3	3	-
CO 4	3	3	3	3	2	-	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT 1:

Introduction to Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks andChallenges.

Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models and Cloud DeploymentModels.

UNIT 2:

Cloud Enabling Technologies: Broadband Networks and Internet Architecture, Data Center Technology; Virtualization Technology; Web Technology; Multitenant Technology; Service Technology.

Cloud Infrastructure Mechanisms: Logical Network Perimeter; Virtual Server; Cloud Storage Device; Cloud Usage Monitor; Resource Replication; Ready-made environment

UNIT 3:

Specialized Cloud Mechanisms: Automated Scaling Listener; Load Balancer; SLA Monitor;Pay-per-use Monitor; Audit Monitor; Failover System; Hypervisor; Resource cluster; Multi-device Broker; State Management DatabaseCloud Management Mechanisms: Remote Administration System; Resource Management System; SLA Management System; Billing Management System.

Unit 4:

BigData: The Data Explosion, Why is big data special? Storing Big Data, Big Data Analytics, Big data and medicine, big data & big business, big data security and big data & society.

Self-Learning Components: Implementation of different Cloud Service Delivery and Deployment Models.

TEXT BOOKS:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI, 2013.
2. Dawn. E. Holmes," Big Data- A short Introduction", Oxford University Press, 2017.

REFERENCE BOOKS:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, MK, 2017. RajkumarBuyya, JamesBroberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms, Wiley, 2011 by john wiley& Sons.
2. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications, CAMBRIDGE, 2010.
3. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra, Distributed and Cloud Computing, MK,20l2
4. Michael Collier, Robin Shahan, Fundamentals of Azure-Microsoft Azure Essentials, Microsoft Press, 2ndEdition,20l6.
5. Neil Peterson, Get started guide for Azure IT operators, Microsoft,20l6. Roberto Brunetti, Windows Azure-Step by Step, OreillyMedia,20ll.
6. Journal of Cloud Computing -Advances, Systems and Applications, Springer Open. International Journal of Cloud Computing, INDERSCIENCE Publishers. l0. IEEE Transactions on Cloud Computing
7. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

B18CS6031	Signal Processing with SCILAB	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Multivariable calculus and Linear algebra (B18CS1010)

CourseDescription:

This course provides insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations, understanding of signal representation in Frequency domain, discrete Fourier transform and its properties. It introduces fast Fourier transform and finite impulse response filter designing. It analyses infinite impulse response filter designing.

Course Objectives:

1. Explain the Discrete Fourier Transform (DFT) properties.
2. Describe algorithms to compute DFT & IDFT, FFT MATLAB commands.
3. Enumerate various characteristics of commonly used analog filters
4. Discuss various Designs of FIR Filters and Digital Filter Structures.

Course Outcomes

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

CO1: Make use of discrete Fourier transform to represent signal in frequency domain.

CO2: Identify and solve signal representation problems using DFT properties with fast Fourier transforms using radix-2 form.

CO3: Design IIR filters in analog domain and linear phase FIR filters using windows.

CO4: Apply the frequency transformation techniques inreal world applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	1	-	-	-	-	-	3	-	-
CO2	2	3	-	1	-	-	2	-	-	-	-	-	-	3	-
CO3	2	-	1	-	-	2	-	1	-	-	-	-	3	3	-
CO4	3	2	-	-	3	1	-	2	-	-	-	-	-	-	-

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

Course Content:

Unit-1:

Discrete Fourier Transforms & its properties: The Discrete Fourier Transform (DFT)- Definition & Concept, and Properties of DFT: Periodicity, Linearity, and Symmetry Properties, Circular Convolution, Additional DFT Properties. Problems. DFT SCILAB commands

Unit -2:

Fast Fourier Transform Algorithms: A linear filtering approach based on DFT, Filtering of long data sequences using overlap - add method, direct computation of the DFT, efficient computation of the DFT, FFT algorithms: Radix-2DIT-FFT, DIF-FFT algorithms to compute DFT & IDFT, FFT SCILAB commands.

Unit -3:

Design of IIR Filters: Characteristics of commonly used analog filters, design of Butterworth and Chebyshevanalog filters. Frequency transformations in the analog domain, design of digital IIR Butterworth. IIR MATLABcommands.

Unit -4:

Design of FIR Filters and Digital Filter Structures: Introduction to Linear-phase FIR filters, Symmetric and Anti-symmetric FIR Filters, Design of Linear phase FIR filters using windowing technique: Rectangular, Hamming & Kaiser windows. Design of Linear phase FIR filters by frequency sampling method. Implementation of FIR digital filters: Frequency sampling structures, direct form-I Linear phase structures, Implementation of IIR digital filters: Direct form-I & Direct form-II structures, filter SCILAB commands.

Self-learning component:

Implement the above using Scilab and Octave instead of Matlab.

TEXTBOOKS:

1. Proakis & Monalakis, “Digital signal processing-Principles Algorithms & Applications”, PHI, 4th Edition, New Delhi, 2007.
2. SanjitKMitra, “Digital signal Laboratory using MATLAB”, MGHEd.2000.
3. Ashok Ambardar, “Digital signal processing: A modern Introduction”, CengageLearning, 2009.

REFERENCEBOOKS:

1. Oppenheim & Schaffer, “Discrete Time Signal Processing”, PHI,2003.
2. S.K. Mitra, “Digital Signal Processing”, Tata Mc-Graw Hill, 2nd Edition,2004.

B18CS6032	Principles of Programming Languages	L	T	P	C
Duration:14 Wks		3	0	0	3

Pre-requisites

JavaScript, Ruby, Python(B18CS5020), Java(B18CS3030), C++ (B18CS2030), Data Structures(B18CS3040), Design and Analysis of Algorithms(B18CS4010), and Finate automata and Formal Languages(B18CS5010).

Course description:

The course is aimed at introducing the student with the general concepts common to all programming languages so as to make them learn new languages. The course describes overview of Compilation Programming Language Syntax , Specifying Syntax, Scanning, Parsing, Theoretical Foundations, Semantic Analysis,Core Issues in Language Design,Type Systems.

Course Objectives

The objectives of this course are to:

1. Explain the fundamentals of programming languages design and implementation.
2. Describe Names, Scopes, and Bindings of objects, variables.
3. Discuss various machine architectures and issues in language design.
4. Illustrate the use of Composite Types, Records (Structures), Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output structures, data abstraction.

Course Outcomes

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

CO1: Utilize the fundamentals of programming languages to implement real world applications.

CO2: Compare Scopes, and Bindings of various objects and variablesused in given real world application.

CO3: Identify the issues in language design based on target machine architecture**.**

CO4: Develop real world applications using type systems.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	-	-	1	-	-	1	1	3	-	-
CO2	1	2	1	1	2	-	-	1	-	-	-	-	-	3	-
CO3	1	2	2	2	1	-	-	1	-	-	1	-	3	3	-
CO4	1	2	2	2	3	-	-	1	-	-	-		-	-	-

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

Course Content:

Unit 1:

Introduction: The Art of Language Design, The Programming Language Spectrum, Why Study Programming Languages? Compilation and Interpretation, Programming Environments, An Overview of Compilation

Programming Language Syntax : Specifying Syntax, Scanning, Parsing, Theoretical Foundations

Unit 2:

Names, Scopes, 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, Separate Compilation

Semantic Analysis: The Role of the Semantic Analyzer, Attribute Grammars,Evaluating Attributes, Action Routines, Space Management for Attributes, Bottom-Up Evaluation, Top- Down Evaluation, Tree Grammars and Syntax Tree Decoration

Unit 3:

Target Machine Architecture: The Memory Hierarchy, Data Representation, Instruction Set Architecture (ISA), Architecture and Implementation, Compiling for Modern Processors

Core Issues in Language Design: Control Flow, Expression Evaluation, Structured and Unstructured Flow, Sequencing, Selection, Iteration, Recursion, Nondeterminancy

Unit 4:

Type Systems: Overview, Type Checking, Parametric Polymorphism, Equality Testing and Assignment, Composite Types, Records (Structures), Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output Subroutines and Control Abstraction, Review of Stack Layout, Calling Sequences, Parameter Passing, Exception Handling, Coroutines, Events

Data Abstraction and Object Orientation: Object-Oriented Programming, Encapsulation and Inheritance, Initialization and Finalization, Dynamic Method Binding, Mix-in Inheritance, True Multiple Inheritance,Object-Oriented Programming Revisited

Self-Learning Component:

Alternative Programming Models, Functional Languages, Logic Languages, Concurrency, Scripting Languages.

TEXT BOOKS

1.Michael L. Scott, “Programming Language Pragmatics” 4th Edition, Morgan Kaufmann Publishers ,

2.Robert W. Sebesta, “Concepts of Programming Languages”, 11th Edition , University of Colorado, Colorado Springs ©2016 |Pearson

3. R. Toal, R. Rivera, A. Schneider, and E. Choe, “Programming Language Explorations”, CRC Press, 2017.

REFERENCE BOOKS:

1. M Hennessey, The Semantics of Programming Languages, John Wiley, 1990.

2. IEEE, IEEE Transactions on Computers.

3. Elsevier, Computer Languages, Systems and Structures.

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

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

B18CS6033	Compiler Design	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Finite Automata and formal languages (B18CS5010)

Course Description:

The Course intends to make students learn the techniques needed for compiler construction and also develops analytical skills. The course is conceptual.

Course Objectives:

1. Explain the concepts of Object-Oriented programming, Object-Relational Databases and Compilers.
2. Describe how syntax tree can be constructed to check the syntax of the given input.
3. Discuss different types of parsers and syntax directed definition and translation.
4. Demonstrate how code optimization and code generation is done for a given source code.

Course Outcomes (Cos):

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

CO1 : Identify the lexical, syntactic and semantic analysis into meaningful phases for a compiler to translate statements of source language.

CO2 : Experiment the knowledge of different parsers by constructing the top down and SLR parsers.

CO3 : Make use of different types of parsers and syntax directed definition and translation to check the syntax of the given input.

CO4 : Develop the code optimization and code generation for a given source code.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	1	1	3	-	-

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

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

Course Content:

Unit- 1

Introduction to Compilers: Language processors; the structure of a Compiler;

Lexical analysis: Tokens, Regular expressions, Finite state automata, translating regular expressions into finite state automata;

Unit -2

Syntax analysis 1: Context-free grammars, Derivations and syntax trees, Handling ambiguous grammars, Top-down parsing, Bottom-up parsing - SLR( );

Unit- 3

Syntax Analysis 2: More powerful LR Parsers;

Syntax-directed translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Parser stack implementation of Postfix SDT;

Unit- 4

Code optimization and generation: Basic blocks and Flow graphs; Optimization of basic blocks;

Intermediate code generation: Variants of syntax trees; Three-address code; Control flow; back patching;

Self-learning component:

More Recent Applications: translating regular expressions into finite state automata; survey of latest compilers for dealing with parallel programming.

TEXT BOOKS:

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

2. Charles N. Fischer, Richard J. leBlanc, Jr., Crafting a Compiler with C, Pearson Education, 1991.

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

REFERENCE BOOKS:

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

2. IEEE, IEEE Transactions on Computers.

3. Elsevier, Computer Languages, Systems and Structures.

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

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

B18CS6034	Artificial Intelligence	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for Problem solving [B18CS1030]

CourseDescription:

This course introduces the basics of Artificial Intelligence (AI), AI problems and search strategies.The students can explore knowledge representation issues and methods.This course provides planning methods /algorithms for, problem solving and controlling the knowledge and also demonstrates various learning methods for constructing knowledge and taking decisions.

Course Objectives

The objectives of this course are to:

1. Discuss the basics of Artificial Intelligence (AI).
2. Illustrate knowledge representation issues and methods
3. Explain planning methods/algorithms in problem solving
4. Demonstrate various learning methods for constructing knowledge.

Course Outcomes (Cos):

At the end of the course, the students shall be able to:

CO1: Explain basics of Artificial Intelligence and AI search strategies.

CO2: Represent knowledge using logic and apply reasoning methods

CO3: Construct plans using agent technology for solving problems.

C04: Employ learning and reasoning methods in programs for constructing the Knowledge.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	2	3	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	-	-	-

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

Course Contents:

Unit 1:

Problems and search: What is AI, AI Problems; AI Techniques; Problem Space and Problem Search techniques; Defining the problem as a state space search, production systems; Problem characteristics, production system characteristics, Issues in the design of search programs; Heuristic search techniques, generate-and-test; Hill climbing, BFS, DFS; Problem reduction; Constraint satisfaction

Unit 2:

Knowledge Representation: Knowledge representation Issues, representations and mappings; Approaches to knowledge representation; Issues in knowledge representation; Using Predicate logic: Representing simple facts in logic; Representing Instance and ISA relationships; Computable functions and predicates; Representing Knowledge using Rules; Procedural versus declarative knowledge; Resolution Forward versus backward reasoning; Matching

Unit 3:

Planning: A simple planning agent; Representations for planning; A partial-order planning example; A partial-order planning algorithm; Planning with partially Instantiated operators; Knowledge Engineering for planning; Uncertainty: Sources of Uncertainty; Probability Theory, Issues with Probability; Advantages & Disadvantages of Bayesian Network

Unit 4:

Learning: Learningfromobservations;Inductivelearning;Ageneralmodeloflearningagents; 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; Examples: Connection to server, creating database, selecting a database; Active learning in an unknown environment; Neural Networks; Applications of NeuralNetworks

Self-Learning Components:

PEAS (Performance, Environment, Actuators and Sensors) for Agents ,Genetic Algorithm, Distributed Agents, Wumpus World game (Understanding the game and applying planning and learning rules),Bioinformatics.

TEXT BOOKS:

1. Russell &Norvig: Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.
2. ElaineRich, KevinKnight: Artificial Intelligence,3rd edition, TataMcgrawHill,2009.
3. TimothyJ. Ross: Fuzzy Logic with Engineering applications: ThirdEdition,2010

REFERENCE BOOKS

1. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.
2. Krishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.
3. B. Yegananarayana: Artificial Neural Networks, PHI, 2001.
4. ACM, ACM transaction on Multi-Agent System.
5. IEEE, IEEE transaction for computational Intelligence.
6. Springer, Springer transaction for security based intelligent systems.

B18CS6035	Computer Design with Verilog	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Digital Logic Design [B18CS3010]

Course Description:

This course aims to provide students with the understanding of the different technologies related to HDLs, construct, compile and execute Verilog HDL programs using provided software tools. Design digital components and circuits that are testable, reusable, and synthesizable.

Course Objectives (Cos):

The objectives of this course are to:

1. Illustrate Verilog hardware description languages (HDL).
2. Discuss digital circuits required for various applications.
3. Explain the verification of Behavioral and RTL models.
4. Describe Synthesizing RTL models to standard cell libraries and FPGAs

Course Outcomes (Cos):

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

CO1: Make use of Verilog hardware description languages (HDL) for Gate Level Modeling

CO2: Design digital circuitsusing Verilog for real world applications.

CO3: Make use of Shift registers and counters toconstructs Verilog.

CO4: Develop Verilog code using Moore and mealy models for realizing Serial Adder.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	2	-	-	-	-	-	-	-	3	-	-

CO 2	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO 3	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

UNIT -1

ASIC Design Flow, Introduction to Verilog, Language Constructs and Conventions in Verilog, Gate Level Modeling, Architecture of FPGA

UNIT -2

Modeling at Data Flow Level, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators, Verilog for combinational Circuits, Design of Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter.

UNIT -3

Behavioral Modeling: Operator and Assignments, Functional Bifurcation, Initial & Always Construct, Assignments with Delays, wait construct, Multiple always blocks, If and if-else, assign-deassign, repeat Construct, Loop Construct: for, while& forever, Parallel blocks, force- release construct, event Design of Flip flop, Shift register and Counters using Verilog.

UNIT -4

Functions, Tasks, user defined primitives, State Machine: Moore and mealy state model, Verilog code for Moore-type FSM, Specification of Mealy FSM using Verilog, Mealy-type and Moore-type FSM for Serial Adder.

Self-Learning Component:

Mealy-type and Moore type FSM for Serial Adder.

TEXT BOOKS:

1. S. Brown & Z. Vransesic, Fundamental of digital Logic with Verilog design, TMH, 2002

2. T.R. Padmanabhan& B. Bala Tripura Sundari, Design through Verilog HDL, Wiley Publcations, 2009

REFERENCE BOOKS:

1. Frank Vahid, Digital Design, Wiley, 2006.

2. M. Ercegovac, T. Lang and L.J. Moreno, Introduction to Digital Systems, Wiley, 2000.

B18CS6041	Digital Image Processing	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Signals and Systems [B18CS4051]

Course Description:

The course covers fundamentals of digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

Course Objectives:

The objectives of the course are.

1. Discuss the fundamental steps of Image Processing
2. Explain different filtering operations in spatial domain for smoothening and sharpening the images
3. Describe the concept of Image restoration.
4. Inculcate knowledge about image compression and color employ image processing techniques for various applications.

Course Outcomes:

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

CO1: Make use of the fundamental steps in digital Image Processing for Zooming and Shrinking Digital Images.

CO2: Utilze different filtering operations in spatial and frequency domain for smoothening and sharpening the images.

CO3: Develop real world applications usingFiltering techniques for image enhancement and restoration.

CO4: Apply colour image processing, image compression and image segmentation in real world applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	3	3	3	1	-	-	-	-	-	3	-	-
CO 2	3	3	2	3	3	1	-	-	-	-	-	-	-	3	-

CO 3	**3**	**3**	**2**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

UNIT -1

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, and Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

UNIT -2

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency- Domain Filters, Sharpening Frequency- Domain Filters, Holomorphic Filtering.

UNIT -3

Image Restoration: 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 Square Filtering, Geometric Mean Filter.

UNIT -4

Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full- Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection,

Self-Learning Component:

Thresholding, Region-Based Segmentation.

TEXT BOOKS

1. Gonzalez and Woods, Digital Image Processing ,2nd Edition, Prentice Hall,2008

2. Anil. K. Jain, Fundamentals of Digital image processing, Prentice Hall,2004.

REFERENCE BOOKS:

1. Alasdair Mc Andrew; Introduction to Digital Image Processing; Cengage learning; 2009.

2. J. G. Proakis; Introduction to Digital Signal Processing; PHI.

3. IEEE transactions on image processing

4. ACM Transactions on image processing

B18CS6042	Advanced Java Programming	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming with Java [B18CS3030], Data Structures [B18CS3040].

Course Description:

This course intends to provide a clear understanding of each of the topics of Advanced Java Programming. The course covers advanced concepts of JAVA programming JSP, Servlets, Networking and database programming, Advanced GUI, Java Beans and Distributed Objects. The course also introduces students to advanced research topics. Students are expected to do independent reading of research papers and make class presentations.

Course Objectives:

The objectives of the course are to:

1. Explain the concepts required for developing the web applications using JSP and Servlets.
2. Demonstrate the use of networking and databases in real world applications.
3. Illustrate the development of GUI programs using Swings and AWT concepts.
4. Discuss the use of Java Beans and distributed objects in real world applications.

Course Outcomes (COs):

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

CO1 : Develop Web page using JSP and Servlets for real world applications.

CO2 : Make use of networking concepts to design a socket to connect to a HTTP server, and database concepts to demonstrate SQL queries.

CO3 : Develop GUI Programs to create a login screen using Swings and AWT concepts.

CO4 : Build a simple calculator application using Java Beans and web service using JAX-WS for accessing information from the web server.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	3	3	-	-	-	-	-	-	-	3	-	-
CO2	3	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	3	1	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	1	3	3	3	-	-	-	-	-	-	-	-	-	-

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

Course Content:

Unit - 1

JSP and Servlets: JSP: Introduction, Jsp Life Cycle, Jsp Implicit Objects & Scopes, Jsp Directives, Jsp Scripting Elements, Jsp Actions, JSTL & Tag Library; Servlets: Introduction, Web application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Servlet Communication-Servlet-Browser communication, Web-component Communication, Servlet- Applet Communication, Session Tracking Mechanisms, Filters & Wrappers, Listeners, Web- Security;

Unit -2

Networking and Database Programming: Networking: Connecting to a Server, Implementing servers, Interruptible Sockets, Sending Email, Making URL Connections; Database Programming: The Design of JDBC, SQL, JDBC Configuration, Executing SQL statements, Query Execution, Result sets, row sets, Metadata, Transactions, Connection Management in Web and Enterprise Applications, Introduction to LDAP.

Unit - 3

Advanced Swings and AWT: Advanced Swings: Lists, Tables, Trees, Text Components, Progress Indicators, Components Organizers; Advanced AWT: The Rendering Pipeline, Shapes, Areas, Strokes, Paint, Coordinate Transformations, Clipping, Transparency and Composition, Readers and Writers for Images, Image Manipulation, Printing, Clip Board, Drag and Drop, Platform Integration,

Unit - 4

Java Beans and Distributed Objects: Bean- Writing Process, Using Beans to Build and Application, Naming Patters for Bean Properties and Events, Bean Info Classes, Property editors, Customizers, JavaBean Persistence; Distributed Objects: Remote Method Calls, The RMI Programming Model, Parameters and Return Values in Remote Methods, Remote Object Activation, Web Services and JAX-WS.

Self-learning component:

File handling and Extended Mark-up Language (XML).

TEXT BOOKS

1. Steven Holzner, Java Black Book, Black Group Books, 2000

2. Uttam K Roy, Advanced Java Programming, Oxford Press, 2015.

3. Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics,3rd edition, Thomson Press, 2003.

REFERENCE BOOKS

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Java, 6th Edition, Wiley, 2014.

2. Robert Lafore, Data Structures and Algorithms in Java, 2nd Edition, Sams, 2002

3. Danny Poo; Object-Oriented Programming and Java; Second Edition; Springer; 2008

4. H.M. Dietel and P.J. Dietel; Java How to Program; Sixth Edition; Pearson Education/PHI

5. Cay. S. Horstmann and Gary Cornell; Core Java 2, Vol 1, Fundamentals; Seventh Edition; Pearson Education/PHI

6. Cay. S. Horstmann and Gary Cornell; Core Java 2, Vol 2, Advanced Features; Seventh Edition; Pearson Education/PHI.

B18CS6043	Data Mining and Warehousing	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Database Management systems (B18CS4030)

Course Description:

Data warehousing and data mining are two major areas of exploration for knowledge discovery in databases. Data mining is for relatively unstructured data for which more sophisticated techniques are needed. The course aims to cover powerful data mining techniques including clustering, association rules. It then teaches high volume data processing mechanisms by building warehouse schemas such as snowflake, and star.

Course Objectives

The objectives of this course are to:

1. Describe the basic concepts of Data Warehouse and Data Mining techniques.
2. Illustrate the processing of raw data to make it suitable for various data mining algorithms.
3. Explain the measurement of interesting patterns in different databases
4. Discuss the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Course Outcomes (Cos):

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

CO1: Outline the basic concepts of Data Warehouse and Data Mining techniques.

CO2: Make use of preprocessing techniques to process raw data to make it suitable for various data mining algorithms.

CO3: Solve classification problems using by identifying suitable machine learning algorithm.

CO4: Apply the techniques of clustering to cluster real world data.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO 1	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO 2	**2**	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**-**
CO 3	**2**	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**-**
CO 4	**2**	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

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

Course Contents:

Unit - 1

Data Warehousing: Introduction, Operational Data Stores (ODS), Extraction TransformationLoading (ETL), Data Warehouses, Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata, Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube.

Unit -2

Data Mining: What is Data Mining? Motivating Challenges, The origins of data mining, Data MiningTasks, Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization

Unit – 3

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 – 4

Clustering: Clustering Techniques: Overview, features of cluster analysis, Types of Data andComputing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis.

Self-learning component:

Decision Trees, Rule Based Classifiers, Nearest Neighbour Classifiers.

TEXT BOOKS:

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2007.

2. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2008.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall

of India, 2006.

3. Data Mining and Knowledge Science – Springer.

4. Inderscience, The International Journal ofDataMining, Modelling and Management-

5. IEEE, IEEE Transactions on Knowledge and Data Engineering.

B18CS6044	System Modeling and Simulation	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Probability and Statistics (B18CS2010).

Course Description:

System modelling is a process of development of a model for a real world operation. Model is built to check the feasibility of implementation of the real world applications. Simulation is the imitation of the operation of a real world system that gives information about the system being investigated. . The system may be electrical, electronic, industrial, and chemical. The activities of the model consist of events, or inputs and outputs, which are activated at certain points in time and in this way affect the overall state of the system.

Course Objectives:

Objectives of this course are to:

1. Explain the concept of simulation along with single channel and multichannel queuing system.
2. Illustrate the working of discrete event system and manual simulation with respect to event scheduling algorithm.
3. Discuss random number generation and variates with different testing techniques.
4. Describe how to model, calibrate, verify and validate a software model along with simulation.

Course Outcomes (Cos):

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

CO1 : Make use of the simulation tools in real world applications.

CO2 : Analyse the concept of scheduling w.r.t time and events simulation analysis.

CO3: Develop an application program for generation of random numbers and random variates using different techniques.

CO4 : Compare Verification and Validation of simulation models for given real world data.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	2	-	-	-	-	-	-	-	3	-	-
CO 2	3	2	2	1	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	1	3	2	2	-	-	-	-	-	-	-	3	3	-
CO 4	3	1	2	2	3	-	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT- 1

Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, Discrete Event system simulation, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System.

UNIT -2

General Principles: Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling, list processing.

Statistical models in simulation: Review of terminology and concepts; Useful statistical models, Discrete distribution: Bernoulli distribution, Binomial distribution, Geometric and Poisson distribution. Continuous distribution: Uniform distribution, Exponential distribution and normal distribution.

UNIT- 3

Random Numbers: Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test.

Random Variate Generation: Inverse Transform Technique- Exponential, Uniform distributions, direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance Rejection Technique.

UNIT- 4

Analysis of Simulation Data

Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis.

Verification and Validation of Model: Model Building, Verification, Calibration and Validation of Models.

Self-learning component:

Types of simulations with respect to output analysis; Output analysis for terminating simulations; Output analysis for steady-state simulations.

TEXT BOOKS

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, Discrete-Event System Simulation, Pearson Education, 4th Edition, 2007.
2. Lawrence M. Leemis, Stephen K. Park, Discrete – Event Simulation: A First Course Pearson Education/ Prentice-Hall India, 2006.

REFERENCE BOOKS:

1. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1991
2. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering series, 4th Edition.
3. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004

B18CS6045	Research Methodology	L	T	P	C
Duration :14Wks		4	0	0	4

Pre-Requisites:

Fundamental knowledge in C/C++, Java & MS-World

Course Description:

This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. Includes computer applications for research. This course introduces research methods as they apply to the higher education (HIED) field of study. HIED 695 provides a macroperspective of the methods associated with conducting scholarly research in all follow-on core, elective, quantitative and qualitative courses; and the doctoral dissertation. Completion of HIED 695 is a prerequisite for follow-on tools courses.

Course Objectives:

The objectives of this course are to:

1. Discuss the dimensions and methods of research.
2. Design 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. Explain the knowledge and skills required for undertaking a research project, for presenting a conference paper and for writing a scientific article.

Course Outcomes:

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

CO1: Make use of the dimensions and methods of research for solving real world problems

CO2: Identify the appropriate research problem and parameters to carry out the research work

CO3: Apply different research skills in preparing proposal for research project and technical paper.

CO4: Create IPR documents using Latex Tool.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	2	2	-	1	3	-	-	-	-	-	-	2	-	3	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 4	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-

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

CourseContent:

Unit - 1:

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 (Kothari)

Defining research problem: selecting the problem - necessity of defining the problem - techniques involved in defining a problem. (Kothari)

Unit - 2:

Research design: Meaning of research design - need for research design - features of good design - different research designs - basic principles of experimental design. (Kothari)

Originality in Research- research skills - time management - role of supervisor and scholar - interaction with subject experts. (Oliver, Stephen Covey, Slides from Net)

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. (Slides from net)

Thesis Writing: The preliminary pages and the introduction - the literature review - methodology - the data analysis - the conclusions - the references (in IEEE and ACM format). (Oliver, Slides from Net)

Unit - 3:

Data Collection and Preparation: Sample surveys, sampling errors, types of sampling designs, experiment and surveys, collection of primary data and secondary data, methods, data preparation process, outliers, analysis, statistics. (Kothari)

Descriptive Statistics: measures of central tendency, dispersion, skewness, relationship, kurtosis, sampling distribution, central limit theorem, statistical inference (Kothari)

Introduction to Tools used in Computer Science: MATLAB, NS2/3, C, C++, Java, Web Service, SPSS, SAS, LOTUS, Excel, Latex and Ms Word. (From net)

Unit - 4:

Testing hypothesis: Concepts, testing, critical region, decision, and hypothesis testing for mean proportion and variance, limitations, chi-square test, one-way ANOVA. (Kothari)

Linear Regression Analysis: Simple model, multiple model and T-test. (Kothari)

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.

TEXT BOOKS:

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, New Delhi: Vistaar Publications, 2004.
4. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004.

REFERENCE BOOKS:

1. J. W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 3nd. ed. Sage Publications, 2008.
2. Kumar, Research Methodology: A Step by Step Guide for Beginners, 2nd. ed. Indian: PE, 2005.
3. B. C. Nakra and K. K. Chaudhry, Instrumentation, Measurement and Analysis,2nd. ed. New Delhi: TMH publishing Co. Ltd., 2005.
4. I. Gregory, Ethics in Research, Continuum, 2005.
5. COLIN NEVILLI, " The complete guide to referencing and avoiding plagiarism" , Second Edition published by Open Up Study Skills.
6. RUDRA PRATAP , " Getting Started with MATLAB " , published by Oxford University Press-2010
7. TEERAWAT, ISSARIYAKUL, EKRAM, HOSSAIN – 2008, "Introduction to Network Simulator NS2"

8. https://www.stir.ac.uk/media/services/registry/quality/BookofPlagiarism.pdfceur-ws.org/Vol-706/poster22.pdf
9. https://books.google.co.in/books?isbn=1446281094
10. www.nalsarpro.org/pl/projects/modelproject2.pdf
11. www.uninova.pt/cam/teaching/SRMT/SRMTunit11.pdf
12. http://matlab_tools.myetang.com/index_e.html

B18CS6051	Pattern Recognition	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Linear Algebra (B18CS1010)

Course Description:

The course provides an overview of the theory, principles and algorithms used to construct high performance information processing systems that learn from experience. The course discusses main and modern concepts for model selection and parameter estimation in recognition, decision making and statistical learning problems.

Course Objectives:

The objectives of the course are to;

1. Explain pattern recognition concepts and its applications.
2. Discuss various mathematical models required for pattern recognition tasks.
3. Describe the nearest neighbour classifier and bayes classifier
4. Demonstrate the supervised and unsupervised tasks

Course Outcomes (Cos):

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

CO1: Identify the areas where Machine Learning can offer a solution to Pattern Recognition.

CO2: Apply probability and data set to evaluate the pattern recognition features.

CO3: Make use of data structures representation and classifier algorithms to solve pattern recognition problems.

CO4: Develop algorithms for applications involving Pattern Recognition.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes															
	P01	P02	P03	P04	P05	P06	P07	P08	P08	P09	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	3	1	-	-	-	-	-	-	-	-	-	3	-

CO3	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO4	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Contents:

Unit- 1

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

Unit -2

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

Unit- 3

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Basyessian belief network.

Unit- 4

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

Self-learning component:

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples.

TEXT BOOKS

1. Pattern Recognition (An Introduction), V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.

2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996

REFERENCE BOOKS:

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009

3. C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006

B18CS6052	Text and Web Mining	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Probability and statistics [B18CS2010] and Database Management System [B18CS4030].

Course Description:

This course in web and text data mining covers basic concepts and techniques of the data mining and application of these techniques in text data and web data for various types of analysis. The course also introduces some research topics which can be used for implementation in projects.

Course Objectives:

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

Course Outcomes:

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

CO1: Choose the Data mining techniques to extract data from given dataset.

CO2: Apply appropriate classification algorithm to analyze the given data.

CO3: Identify suitable Web Mining technique to perform social network analysis.

CO4: Design web crawlers for information retrieval from web.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	2	2	2	-	-	-	-	-	-	-	3	-	-
CO 2	2	3	1	2	1	-	-	-	-	-	-	-	-	3	-

CO 3	**2**	**1**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**2**	**2**	**1**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

UNIT- 1

Introduction to Data Mining Techniques:

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

UNIT -2

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

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

UNIT- 3

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

UNIT- 4

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

Self-learning component:

PageRank for Social network analysis and Focused Crawlers

TEXT BOOKS

1. Michael W. Berry and Jacob Kogan, Text Mining: Applications and Theory, Wiley, 2010

2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents and Usage Data, springer, 2007.

REFERENCE BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier, 2011.

2. ACM Transactions on Knowledge Discovery from Data (TKDD)

3. IEEE Transactions on Knowledge and Data Engineering.

B18CS6053	Wireless and Mobile Networks	L	T	P	C
Duration :14Wks		3	0	0	3

Pre-requisites:

Computer Networking (18BCS53)

Course Description:

This course will introduce to wireless communication and mobile computing. It covers the fundamentals of wireless transmission and telecommunication system such as GSM, GPRS, DECT, and UMTS. Mobile network layer and transport layers covers about mobile IP, Traditional TCP and the architecture of LTE and its protocol.

Course Objectives:

1. Explain the basic concepts of wireless communication.
2. Describe wireless network architecture and concepts of Ad-hoc network.
3. Demonstrate the working of wireless Local area networks and wireless ad-hoc networks.
4. Discuss various applications using the wireless technologies

Course Outcomes (Cos):

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

CO1 : Use the concepts of wireless communication and networks in designing communication systems.

CO2 : Demonstrate the design and applications of Cellular and wireless networks.

CO3 : Apply WAP, 4G and 5G networks for better internet services and applications.

CO4 : Develop applications using the wireless technologies.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	2	2	-	2	-	-	-	-	-	3	-	-
CO 2	3	3	2	2	3	-	2	-	-	-	-	-	-	3	-

CO 3	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**3**	**3**	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Contents:

UNIT -1

Introduction: Fundamentals of wireless communication: Wireless communication system, Wireless media, Frequency spectrum. Introduction to PCM and variants, QPSK, FHSS, DSSS, MIMO and OFDM. Wireless communication channel specifications, Types of wireless communication systems.

Basics of wireless networks: Wireless network architecture, Wireless network reference model, Wireless networking issues.

UNIT -2

Telecommunication System: Global system for mobile communications (GSM) Services, System Architecture, General packet radio service (GPRS) architecture, handover in GSM. DECT System Architecture, TETRA and UMTS System Architecture.

Wireless Body Area Networks: Properties, Network architecture, Components, List of MAC protocols, working of SMAC , TMACand BMAC. Network Protocols listing, working of LEACH SPIN and SPAN. Introduction to Bluetooth and Zigbee. WBAN Applications.

UNIT -3

Wireless Local Area Networks: Network Components, Network architecture, WLAN standards, WLAN protocols, IEEE 802.11p, WLAN applications.

Wireless Ad Hoc Networks: Mobile Ad Hoc networks architecture, MACA MAC protocol, AODV and DSR and routing protocol, Wireless sensor networks architecture, EAR, Gossip, Flooding, LEACH protocol, Vehicular Ad Hoc networks (VANETs) architecture and applications.

UNIT -4

Wireless Application protocol: Version 1.X Architecture, WAP 2.0.

4G LTE Networks: Introduction, LTE, LTE Architecture, Protocol layer Architecture, LTE Advanced, 5G Networks overview.

Self-learning components:

Network Function Virtualization (NFV), Capability-based Security,5G, Cyber Physical Systems (CPS), and Capability-based Security.

TEXTBOOKS:

1. Sunil Kumar S. Manvi, Mahabaleshwar S. Kakkasageri, Wireless and mobile networks concepts and protocols- , second edition, Wiley,2016.
2. Jochen H. Schillier, Mobile Communications, 2nd edition, Pearson publishers.

REFERENCE BOOKS:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile computing technology, Application and service creation, Second edition, Tata McGraw Hill Education Private limited, 2010.

2. IEEE Transactions on Vehicular Technology

3. IEEE Transactions on Wireless Communications

4. Springer Wireless Networks Journal

B18CS6054	Parallel Processing and Algorithms	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Computer organization and Architecture (B18CS4040), Problem Solving with Programming (B18CS1030), Design and Analysis of Algorithm (B18CS4010).

Course Description:

In a parallel computation, multiple processors work together to solve a given problem. These are exciting times in parallel computing. The largest parallel machine has over a hundred thousand processors, and it is believed that machines with over ten thousand processors will be commonly available by the end of the decade. Furthermore, with most chip manufacturers moving toward multicore processors, most machines will soon be parallel ones. It is, therefore, essential to learn to use parallel machines effectively.

Course Objectives:

1. Explain the concepts of parallelism.
2. Demonstrate the use of OpenMP for implementing shared memory concepts.
3. Discuss the computational bottlenecks of basic computational problems.
4. Illustrate the use of graph algorithms for solving problems.

Course Outcomes (Cos):

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

CO1: Make use of the parallelism concepts in Parallel Programming Platforms.

CO2: Develop parallel programs using OpenMP and pthreads for real world applications.

CO3: Analyze computational bottlenecks of basic computational problems.

CO4: Develop programs using graph algorithms for solving Shortest Paths and Transitive Closure problems.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-

CO 2	**3**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO 3	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**3**	**3**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Contents:

Unit- 1

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms: Implicit Parallelism-Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms. Principles of Parallel Algorithm Design: Decomposition Techniques, Characteristics of Tasks and Interactions, Parallel Algorithm Models.

Unit -2

Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming.

Unit- 3

Dense Matrix Algorithms: Matrix-Matrix Multiplication. Sorting: Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Quicksort. Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm.

Unit- 4

Graph Algorithms continued: Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths and Transitive Closure. Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms.

Self-learning component:

Algorithms merging and sorting, Lower Bounds Lock Free synchronization, load stealing, lock free synchronization.

TEXT BOOKS

1. Introduction to Parallel Computing (2nd Edition). Ananth Grama , George Karypis, Vipin Kumar, Anshul Gupta - Addison Wesley Publications, ISBN : 0-201-64865-2,2003.

REFERENCE BOOKS:

1. Parallel Programming in C with MPI and OpenMP by M.J. Quinn, McGraw-Hill Science/Engineering/Math, 1st edition, ISBN: 0072822562,2003.
2. OpenMP: www.openmp.org/

B18CS6061	Mobile Application Development	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming with Java [B18CS3030], Data Structures [B18CS3040]

Course Description:

This course introduces programming technologies, design and development tools related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using OS Software Development Kit (SDK).

Course Objectives:

1. Discuss mobile application models/architectures and patterns for development of a mobile software application
2. Demonstrate the installation of software and tools required for development of android applications.
3. Illustrate the use of fundamentals of android with graphics and animation APIs.
4. Describe an application with multimedia concepts of audio, video with entertainment services.

Course Outcomes:

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

CO1 : Make use of Android features to develop real world application.

CO2 : Design a suitable user interface and database for the given real-world application.

CO3 : Choose the intrinsic controls required for the development of real-world applications.

CO4 : Develop Android Services for multimedia, camera and location-based activities.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	-	-	-	-	-	-	-	3	-	-
CO2	2	3	2	3	2	2	-	-	-	-	-	2	-	3	-
CO3	2	2	3	1	2	-	-	-	-	-	2	-	3	3	-
CO4	3	3	3	2	2	1	-	-	-	-	1	-	-	-	-

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

Course Content:

Unit-1:

Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security, Smart phone operating systems and smart phones applications.

Unit-2:

Fundamentals of Android Application Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.

Unit-3:

Layouts, Menus and Graphics in Android: Menus: Options menu and app bar,Context menu and contextual action mode,Popup menu, Defining a Menu in XML, Creating an Options Menu, Changing menu items at runtime, Creating Contextual Menus, Creating Menu Groups, Adding Menu Items Based on an Intent, Activity, Service, BroadcastReceiver and Content Provider.

Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.

Unit 4:

Creating the Activity, working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.

Self-learning component:

More Recent Applications: Multimedia;2D graphics; networking support in Android, Introduction to IoS, App. Development.

TEXT BOOKS

1. Bill Phillips, Chris Stewart, and Kristin Marsican, Android Programming: The Big Nerd Ranch Guide pearson technology group,3rd Edition,2015.
2. Barry Burd, Android Application Development All-in-One For Dummies , wiley publisher,2nd Edition, 2012.
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, oRiley,2nd Edition,2012.

REFERENCE BOOKS:

1. Greg Nudelman, Android Design Patterns: Interaction Design Solutions for Developer, wiley, 2013.
2. Jason Tyler, App Inventor for Android: Build Your Own Apps No Experience Required! wiley,2011.
3. J.F. Dimarzio, Android programming with Android studio, wrox,4th edition ,2017
4. Maurice Sharp Erica Sadun Rod Strougo, Learning iOS Development-A Hands-on Guide to the Fundamentals of iOS Programming, Addison Wesley by Pearson Education, Inc.2014.
5. Wei-Meng Lee, Beginning Swift Programming, Wiley India Pvt. Ltd.,2018.

B18CS6062	Advanced Computer Networks	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Computer Organization and Architecture [B18CS4040], Computer Networks [B18CS5030]

Course Description:

This course is designed to introduce advanced topics in computer networks. Algorithms and protocols at the application, transport, network and medium access layers. The course explores emerging research challenges in the field of information and content centric networks. This course assumes students with graduate level knowledge in Computer Networks, familiarity with Operating Systems, Statistics and proficiency in at least one programming language. The course is also organized in traditional lectures, and also students will have chance to study the state-of-art research in Computer Networks field that is particularly interesting to them, and work on it.

Course Objectives:

1. Explain the concepts of SONET and ATM.
2. Discuss the different application protocols.
3. Describe the Congestion Control and Resource Allocation techniques.
4. Demonstrate the management of computer network.

Course Outcomes:

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

CO1: Choose the most appropriate networking architecture and technologies for the given real-world application.

CO2: Identify deficiencies in existing protocols and formulate new and better protocols.

CO3: Design the topological and routing strategies for an IP based networking infrastructure

CO4: Make use of internet socket programming for the given real-world application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	3	2	1	-	-	-	-	-	1	3	-	-

CO 2	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**-**
CO 3	**2**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**
CO 4	**3**	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

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

Course Content:

UNIT-1

SONET: Architecture, SONET Layers, Frames, Multiplexing, Networks.

ATM: Design Goals, Problems, Architecture, ATM Layers, ATM switch structure, ATM LAN's. Applications of ATM networks.

UNIT-2

Application Protocols: BGP, Traditional Applications- SMTP, MIME, IMAP, HTTP, Web services, FTP, TELNET. Multimedia Applications, Infrastructure services-DNS, SNMP.

UNIT-3

Congestion Control and Resource Allocation: Issues in Resource Allocation, Network Model, Taxonomy, Evaluation Criteria. Queuing Disciplines: FIFO, Fair Queuing, Congestion-Avoidance Mechanisms: DECbit, Random Early Detection (RED), Source-Based Congestion Avoidance, Quality of Service: Application Requirements, Integrated Services (RSVP), Differentiated Services (EF, AF), and Equation-Based Congestion Control.

UNIT-4

NetworkManagement: Introduction, SNMP, ASN.1

Socket Programming in Java: Introduction, Programming with UDP, Programming with TCP.

Self-Learning Component:

Project development using (NS3 Tool or NetSim). MPLS, VPN, IGMP. SSH, AES, Blowfish.

TEXT BOOKS

1. Larry L. Peterson & Bruce S. Davie: Computer Networks A Systems Approach, 4th Edition, Elsevier.

2. Behrouz A Forouzan: Data Communications and Networking, 5th Edition, McGraw – Hill, 2006.

REFERENCE BOOKS:

1. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2009

2. Alberto Leon-Garcia and Indra Widjaja: Communication Networks – Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw – Hill, 2004.

3. Andrew S. Tanenbaum: Computer Networks, 4th Edition, Pearson Education, 2005.

4. Larry L. Peterson and Bruce S. Davie: Computer Networks- A system Approach, 5th Edition, Elsevier, 20l2.

5. William Stallings: Data and Computer Communications, l0th Edition, Pearson Education, 2008.

6. Douglas E. Comer: Internetworking with TCP/IP Vol.l, 6th Edition, Pearson, l995.

7. IEEE Network Magazine

8. IET Communications

9. Elsevier Computer Networks

10. Springer Journal of Networks and Systems Management.

B18CS6063	Introduction to Genomic Data Science	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Database Management(B18CS4030)

Course Description:

This is the first course in the Genomic Data Science Specialization. This course introduces to the basic biology of modern genomics and the experimental tools that is used to measure it. Central Dogma of Molecular Biology is introduced and how next-generation sequencing can be used to measure DNA, RNA, and epigenetic patterns is done is covered. An introduction to the key concepts in computing and data science, how data from next-generation sequencing experiments are generated and analyzed are covered.

Course Objectives:

1. Explain the basic concepts of bioinformatics
2. Discuss different information search and data retrieval tools.
3. Demonstrate the use of Genome Analysis and Gene Mapping with respect to a real world Application.
4. Illustrate the use of Gene Identification and Prediction in a real-world application.

Course Outcomes (Cos):

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

CO1: Make use of basic concepts of Bioinformatics

CO2: Apply Search and Data Retrieval for any real-world application.

CO3: Analyze Genome process and Gene Mapping.

CO4: Evaluate Gene Identification and Prediction in Genomic DNA

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	-	3	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-	3	3	-

CO4	**2**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Contents:

Unit- 1

Bioinformatics: **An Introduction**

Introduction, Historical Overview and Definition, Bioinformatics Applications, Major Databases in Bioinformatics, Data Management and Analysis, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology, Biological Databases Considerations.

Unit-2

Information Search and Data Retrieval:

Introduction, Electronic Libraries, Tools for Web Search, Data Retrieval Tools, Data Mining of Biological Databases.

Unit-3

Genome Analysis and Gene Mapping

Introduction, Genome Analysis, Genome Mapping, The Sequence Assembly problem, Genetic Mapping and Linkage Analysis, Physical Maps, Cloning the entire Genome, Genome Sequencing, Applications of Genetic Maps, Sequence Assembly Tools, Identification of Genes in Contigs, The Human Genome Project.

Unit-4

Gene Identification and Prediction

Introduction, Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods, Other Gene Prediction Tools.

Self-learning components:

Genome data management, sequencing the pairs of genomes, Hidden Markov Models, Phylogenetics.

TEXT BOOKS

1. S.C. Rastogi, N. Mendiratta, P. Rastogi, Bioinformatics Methods and Applications, 4th Edition, EEE, PHI, 2013.

2. Andreas D. Baxevanis, B. F. Francis Ouellette, BIOINFORMATICS A Practical Guide to the Analysis of Genes and Proteins, 2nd Edition, Wiley Interscience, 2001.

3. Lloyd Low, Martti Tammi, Bioinformatics-Practical-Generation-Sequencing-Applications, 2017

4. T. R. Sharma, Genome-Analysis-Bioinformatics-Practical-Approach, I.K. International Publishing House Pvt. Ltd, 2009

REFERENCE BOOKS:

1. Genomic Data Science | Coursera

2. Introduction to Genomic Data Science | edX

3. Computational Genomics and Data Science Program, National Human Genome Research Institute.

B18CS6064	User Interface (UI)/User Experience (UX) Design	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming with Java [B18CS3030]

Course Description:

This course is designed to give a foundational understanding of how people interact with computers and computing technology, and will provide with a set of basic skills for evaluating and designing for this type of interaction. These are valuable skills to have, especially if a student is considering post-baccalaureate work in the fields of psychology, design, computer science, or plan to work in industry with such technology. Even if a student does not plan to pursue a career in such areas, this is useful information to know to improve his/her own interaction with technology.

Course Objectives:

The overall objectives of the Course are as follows:

1. Explain user interface design process for a given problem
2. Illustrate the selection of designs, utilize the design thinking processes with UX/UI tools.
3. Describe the assumptions and prototype potential design solutions.
4. Discuss the issues and challenges to achieving a human-centered design process especially with regard to user experience design

Course Outcomes (Cos):

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

CO1. Identify the new technologies to design user interfaces for the given real world application.

CO2. Make use of the UI/UX design process to develop the given real world application.

CO3. Develop applications using various Interaction styles including Direct Manipulation and Virtual Environment.

CO4. Design web and mobile UI/UX based application using structure plane.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1	-	-	-	-	2	3	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	1	-	3	-
CO3	3	2	2	2	1	-	-	-	-	-	-	2	3	3	-
CO4	3	3	2	2	1	-	-	-	-	-	-	2	-	-	-

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

Course Content:

UNIT- 1

A Design Process for Digital Products; A Design Process for Digital Products; Modeling Users: Personas and Goals.

UNIT -2

Setting the Vision: Scenarios and Design Requirements; Designing the Product: Framework and Refinement; A Basis for Good Product Behavior

UNIT- 3

User Experience and Why It Matters? Meet the Elements; Understanding the Strategy Plane; Understanding the Scope Plane.

UNIT- 4

Understanding the Structure Plane; Understanding the Skeleton Plane; Understanding the Surface Plane; UI/UX Designing for the Desktop, Mobile and other devices. UI/UX Designing for the web.

Self-Learning Components:

Implementation of Common sight patterns in the Interaction design, Prediction of User expectations, Choosing and using the best UI patterns.

TEXT BOOKS

1.Alan Cooper, About Face-Essential of the User Interface Design, Wiley, 4th edition, 2014

2.Jenifer Tidwell, Designing Interfaces, O'Reilly Media, 2nd edition, 2010.

REFERENCE BOOKS:

1.William Buxton, sketching user experiences-getting the design right and the right design, Elsevier-Morgan Kaufmann, 2007.

2.Don Norman, The Design of Everyday Things - Revised and Expanded Edition, 2013.

3.Jesse James Garrett - The Elements of User Experience-User-Centered Design for the Web and Beyond, 2nd Edition, New Riders Press, 2010.

4.ACM, International Journal of Human-Computer Studies.

5.IEEE, Transactions on Human-Machine Systems.

6.Elsevier, International Journal of Human-Computer Studies.

B18CS6070	Cloud Computing Lab	L	T	P	C
Duration :14Wks		0	0	2	2

Prerequisites:

Operating System[B18CS5040], Computer Networks[B18CS5030], Database Management System[B18CS4030].

Course Description:

The course provides introduction to Google Docs, Google Sheets, Google Slides and Google Forms, describes various virtualization techniques, how to create multiple VM's using VMware products, discuss on MapReduce programming model in Big Data – Hadoop framework using sample data and also provides basic knowledge on IoT applications using Cloud.

Course Objectives:

1. Describe the knowledge of Map Reduce framework in solving problems related to big data.
2. Discuss Google Docs, Google Sheets, Google Slides and Google Forms.
3. Explore hands on experience on cloud environments.
4. Explain IoT applications using Cloud.

Course Outcomes:

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

CO1: Illustrate MapReduce programs on Hadoop and analyze the results.

CO2: Develop documents, spreadsheets, slides and forms using Google Docs, Google Sheets, Google Slides and Google Forms.

CO3: Design simple experiments on VMware products.

CO4: Make use of features of Cloud to develop IoT applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	3	-	-	-	3	3	-	-	3	3	3
CO2	2	3	-	-	-	-	-	-	3	3	-	-	3	3	3
CO3	-	-	-	-	3	-	-	2	3	3	-	-	3	3	3

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

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

List ofExperiments:

Experiment Nos.	Programs
1	Demonstrate on the Virtual Environment on hypervisor. a) Communication between the VM's. b) The backup and restore mechanism.
2	Demonstrate the mechanism of cloning and create a switch with multiple networks having the different VM's.
3	Demonstrates how to simulate a Data Center with one host and run one Cloudlet on it using cloudsim.
4	Demonstrates how to create a datacenter with one host, two virtual machines and run two cloudlets on it. Both virtual machine (vm1,vm2) has same machine configuration.
5	Demonstrates how to create a datacenter with two hosts, two virtual machines and run two cloudlets on it. The cloudlets run in VMs with different MIPS requirements. The second VM will have twice the priority of virtual machine one(VM1) and so cloudlet will receive twice CPU time to complete the execution
6	Demonstrate how to create two datacenters with one host each and run two cloudlets on them.
7	Evaluate the performance of MapReduce program on "word count" for different file size.
8	Evaluate the performance of MapReduce program on "character count" for different file size.

Additional Experiments:

Experiment Nos.	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.

IVth Year
Detailed Syllabus

VII Semester
Syllabus

B18CS7010	Web Application Development	L	T	P	C
Duration :14Wks		3	0	1	4

Prerequisites:

Programming with Java (B18CS3030) and Database Management System (B18CS4030).

Course Description:

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

Course Objectives:

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

Course Outcomes (Cos):

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

CO1 : Build web pages using HTML syntax and semantics.

CO2 : Make use of Cascading Style Sheets in developing web applications.

CO3 : Design and Execute dynamic and interactive web pages by embedding Java Script code in HTML .

CO4 : Apply the principles of object oriented development and database using PHP.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
CO1	3	1	3	3	2	-	-	-	3	3	-	-	3	3	3
CO2	3	2	2	3	2	-	-	-	3	3	-	-	3	3	3
CO3	3	2	3	3	2	-	-	-	3	3	-	-	3	3	3
CO4	3	2	3	3	2	-	-	-	3	3	-	-	3	3	3

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

Course Contents:

Unit- 1

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

Unit -2

Introduction to CSS, what is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, CSS Text Styling. Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

Unit- 3

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

Unit- 4

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

Self-learning component:

HTML5, JQuery, XML, Ruby, Introduction to REST and RESTful API

TEXT BOOKS

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

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

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

REFERENCE BOOKS:

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", O'Reilly Publications, 4th Edition, 2015.

2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, 5th Edition 2016.

3. Nicholas C Zakas, "Professional JavaScript for Web Developers", Wrox/Wiley India, 3rd Edition 2012.

4. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 1st Edition, 2014

5. Zak Ruvalcaba Anne Boehm, "Murach's HTML5 and CSS3", Murachs/Shroff Publishers & Distributors Pvt Ltd, 3rd

Edition, 2016.

6. Gerardus Blokdyk, “Representational State Transfer: Practical Integration”, CreateSpace Independent Publishing Platform, 1st Edition, 2018
7. Michael Fitzgerald, ‘Learning Ruby”, O’Reilly, 1st Edition, 2007

S. No.	Programs
1	In today’s digital world, information dissemination through printed documents consumes lot of time. To overcome this drawback, it is better to adopt digital technology for information dissemination, like e-journals, e-books, e-advertisements, etc. Information dissemination through Internet in the form of web content is essential and convenient option. Design and develop a static web page 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	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3	Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXTSHRINKING” in BLUE color. Then the font size decreases to 5pt.
4	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, and push buttons and so on. Hence it is better to instructor 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.

5	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, emailed and check for validity or correctness of the input data by Writing a JavaScript to validate these fields.
6	Write the PHP programs to do the following: a) Implements calculator operations. b) Find the transpose of a matrix. c) Multiplication of two matrices. d) Addition of two matrices.
7	Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
8	Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
9	Write a PHP program to sort the student records which are stored in the database using selection sort.
10	In any business organization, employees keep traveling across different geographical locations and at the same time they want to be connected to their organization's computing resources such as email server, data base 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.

Sample Assignments:

1. Create a static REVA University web page using HTML tags
2. Create a web page that will have separate links to show map of India and World. When user will open a map of India, create links to display the information of each state i.e. highlighted in the map in a separate window/document. (The information should be brief i.e. not more than 3-4 sentences.)
   When user will open a worldmap, show the list of countries on clicking the image in a new window.
3. Write an HTML page to displayinformation of three products. The name of three productsshould be displayed at the top. The hyperlink should be provided to move to the details of the product like its features, size, price etc. alongwith its image. The link shouldbe internal link.
4. Explain the following tags with the attributes that often required. Write suitable examplefor each. 1) SELECT
   2) TEXTAREA
5. What is CSS and List out the properties of CSS.
6. Differentiate between java and JavaScript.
7. Explain with sample programperl.
8. Explain with sample programphp.
9. Create a website using HTML, perl to store the students information of the school.
10. Discuss the working of admission process using a web page in PHP.

B18CS7020	Cryptography and Network Security	L	T	P	C
Duration:14 Wks		3	0	0	3

Pre-requisites:

Computer Networks [B18CS5030]

Course Description:

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

Course Objectives:

The objectives of this course are to:

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

Course Outcomes (COs):

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

CO1: Identify the fundamental concepts of cryptography.

CO2: Develop a program for implementing public key cryptography and message authentication.

CO3: Build key distribution system using Symmetric or Asymmetric encryption

CO4: Design and develop security applications in the field of Information technology.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	1	-	-	-	-	-	-	-	3	-	-
CO 2	3	2	3	1	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	1	2	2	3	-	-	-	-	-	-	-	3	3	-
CO 4	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-

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

Course Contents:

Unit - 1

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

Unit – 2

Public-Key Cryptography and Message Authentication: Public key Cryptographic Principles, Public Key Cryptographic Algorithms (RSA, Diffie-Hellman), Approaches to Message Authentication, Secure Hash Functions (SHA-512),Message Authentication Codes, Digital Signatures.Introduction to Secure programming with the OpenSSL API: OpenSSL, Headers and initialization, Setting up an unsecured connection, Setting up a secure connection, Error detection.

Unit – 3

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

Unit – 4

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

Self-learning component:

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

TEXT BOOKS

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

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

REFERENCE BOOKS:

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

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

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

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

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

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.

https://www.alienvault.com/blogs/security-essentials/open-source-network-security-tools-for-newbies.

B18CS7031	Internet Computing and Applications	L	T	P	C
Duration:14Wks		3	1	0	4

Prerequisites:

NIL

Course Description:

The course aims to provide an understanding with the principles on which the Internet and other distributed systems are based. Emphasizes the power of Javascript, PHP to design web pages that dynamically interact with databases that reside on a server. Scripting tools to build web pages that connect to servers and Client-Side Programming, Server-Side Programming, Database Connectivity to web applications.

Course Objectives:

The objectives of this course are to:

1. Describe the different types of computer networks.
2. Illustrate the use of distributed system technologies in real world applications.
3. Demonstrate the use of Java script in real world applications.
4. Explain the features of PHP, HTML and MySQL.

Course Outcomes:

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

CO1: Identify the fundamental concepts of networking to connect web-based applications using distributed computing technologies.

CO2: Outline the working of remote method invocation to access remote methods.

CO3: Make use of javascript in web programming to develop web-based applications.

CO4: Develop a real-world application using PHP.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	3	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	3	3	2	1	1	-	-	-	-	-	-	3	-

CO 3	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO 4	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

Unit -1:

Introduction to Networks: Data Communications, Networks: LAN, MAN, WAN, Layers, Protocols and Interfaces of OSI Reference Model and TCP/IP Model.

Internet: URLs, the World Wide Web, WWW Architecture, Web Browsers, Web Servers, Web Search Engines, MIME, HTTP, FTP, Web Service, Software as a service

Unit -2:

Distributed Computing: Client Server, Cloud, parallel computing and Grid computing, Remote Procedure Call (RPC) and Remote Method Invocation (RMI).

Unit 3:

JavaScript: Introduction: Overview of Java Script, Object orientation and Java Script, Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array, Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form handling and validations, Errors in scripts, Example

UNIT 4:

PHP: 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, PHP myadmin and database bugs.

Self-learning component:

Dynamic Documents with Javascript: Positioning elements, Moving elements, Element Visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Dragging and dropping elements, E-Commerce, Real Estate Business, Education, Health, Research and Social Networks like Facebook, FlipKart etc.

TEXT BOOKS

1.M.L. Liu, Distributed computing, Principles and Applications, Pearson Education, 4th edition, 2008.

2.Grid Computing, Joshy Joseph & Craig fell enstein, Pearson Education, 3rd edition, 2004.

3.Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

REFERENCE BOOKS

1.Deitel, Goldberg, 'Internet & World Wide Web How to Program', Third Edition, Pearson Education, 2006.

2.Behrouz A, Forouzan, Data Communication and Networks, Tata McGrahill, 4th Edition, 2006

3.Achyut S. Godbole and AtulKahate, Web Technologies, Tata McGraw Hill, Third edition, 2003.

B18CS7032	Data Structures using C	L	T	P	C
Duration: 14Wks.		3	1	0	4

Prerequisites:

C Programming Knowledge

Course Objectives

The objectives of this course are to:

1. Distnguish between primitive and non-primitive data structures.
2. Demonstrate the use of arrays in real world applications.
3. Explain operations and applications of lists and stacks.
4. Illustrate the use of queues in real world applications.

Course Outcomes

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

CO1 : Identify an appropriate data structure required to represent the data to solve the given problem.

CO2 : Apply the concept of Arrays for solving real world problem.

CO3 : Develop a program using lists and stacks to solve real world problem.

CO4 : Design and develop a real world application using queues.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	1	-	-	-	-	-	-	1	3	-	-
CO 2	3	1	2	2	1	-	-	-	-	-	-	1	-	3	-
CO 3	3	1	3	3	2	-	-	-	-	-	-	3	3	3	-
CO 4	3	2	2	2	1	-	-	-	-	-		3	-	-	-

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

Course Contents:

Unit 1:

Introduction to C and Data Structures: History of C, Data Types, Variables, Constants, Statements, Expressions, Control Statements, Flow Charts, Algorithms, Simple Programs,

Introduction to data structure; Definition, Primitive and non-primitive data types, Data Abstraction.

Unit 2:

Arrays: Single- and two-dimensional arrays, Application of arrays: Dynamic memory allocation, searching and sorting algorithms and simple programs

Unit 3:

Lists and Stacks:

Lists: Definition, Operations, Representation**,** Application of List

Stacks: Definition, Operations, Representation**,** Application of Stack

Unit 4:

Queues and Application of the Course

Queues: Definition, Operations, Representation**,** Application of queue.

Applications of Course:

Application of Data Structures to different domains like Civil, Mechanical, Electrical, Electronics, MBA, etc.

TEXTBOOKS:

1. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
2. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill

B18CS7041	Augmented and Virtual Reality	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Problem Solving with Programming (C/C++)-[B18CS1030], Data Structures-[B18CS3040]

Course Description:

This course covers basic concepts of augmented reality and virtual reality. The course also introduces the student to the working of multiple models of input and output interface in VR. The course also helps the student to understand development tools and frameworks in VR. Further, this course helps the student to work on the application of VR in digital entertainment.

Course Objectives:

The objectives of this course are to:

1. Explain the principles and multidisciplinary features of Virtual Reality.
2. Illustrate the multimodal user interaction and perception in Virtual Reality.
3. Demonstrate the use of objects for managing large scale Virtual Reality environment in real time.
4. Discuss the various solutions using Virtual Reality system framework and development tools for industry and social relevant applications.

Course Outcomes:

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

CO1: Identify the components of Augmented and Virtual Reality.

CO2: Apply multimodal user interaction and perception techniques involved in Virtual Reality.

CO3: Develop real world applications using Simulation and Interactive techniques.

CO4: Choose the innovative Virtual Reality solutions for industrial and social relevant applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	-	-	-	-	-	-	-	-	3	-	-	3	-	-

CO 2	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**
CO 3	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**3**	**3**	**-**
CO 4	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**

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

Course Content:

Unit-1:

Introduction to Augmented Reality (AR): Definition and Scope, A Brief History of Augmented Reality, Examples, Related Fields, System Structure of Augmented Reality, Key Technology in AR.

Introduction to Virtual Reality (VR): Fundamental Concept and Components of VR, Primary Features and Present Development on VR.

Unit-2:

Multiple Models of Input and Output Interface in VR: Input – Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus and 3D Scanner. Output – Visual, Auditory, Haptic Devices.

Unit-3:

Environment Modelling in VR: Geometric Modelling, Behaviour Simulation, Physically Based Simulation.

Interactive Techniques in VR: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Unit 4:

Development Tools and Frameworks in VR: Frameworks of Software Development Tools in VR, X3D Standard, Vega, MultiGen, Virtools, and Unity.

Application of VR in Digital Entertainment: VR Technology in Film and TV Production, VR Technology in Physical Exercises and Games, Demonstration of Digital Entertainment by VR.

Self-learning component:

Unity 3D, Manus VR

TEXT BOOKS

1.Dieter Schmaltzier and Tobias Hollerer. Augmented Reality: Principles and Practice, Addison-Wesley, 2006.

2.Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

REFERENCE BOOKS:

1. Sherman, William R. and Alan B. Craig, Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
2. Fei GAO, Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
3. Guangran LIU, Virtual Reality Technology, Tsinghua Press, Jan. 2011.

4. International Journal of Virtual and Augmented Reality (IJVAR)
5. Springer, Virtual Reality.

B18CS7042	Network Programming	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites

Programming for Problem solving [B18CS1030], Operating systems [B18CS5040], Computer Networks [B18CS5030].

Course Description

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

Course Objectives:

The objectives of this course are to:

1. Illustrate the use of socket programming in a real-world application.
2. Explain the features of client and server Architecture required for developing real world applications.
3. Demonstrate the various methods of securing a network application.
4. Discuss the Case Study of Networked Application and Secure Networked Application

Course Outcomes (Cos):

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

CO1 : Make use of features of socket programming in a real world application.

CO2 : Develop an application for client server Architecture using real world scenarios.

CO3 : Design a secure network application using OPEN SSL and other tools.

CO4 : Analyse Case Study for Networked Application and Secure Networked Application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	-	-	-	-	-	-	-	3	-	-
CO2	2	1	1	3	2	-	-	-	-	-	-	-	-	3	-
CO3	1	1	1	3	3	-	-	-	-	-	-	-	3	3	-

CO4	**1**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content

UNIT - 1

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

UNIT - 2

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

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

UNIT - 3

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

UNIT - 4

Case Study1: A Networked Application: Using the Server and Client

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

Self-Learning Component:

Creating TCP clients, Creating TCP servers, Servers handling multiple clients, Malticast applications.

TEXTBOOKS:

1. Keir Davis, John Turner and Nathan Yocom, “The Definitive Guide to Linux Network Programming’’, Apress, First edition, 2004.
2. Warren Gay, “Linux Socket Programming by Example”, Que, 1st edition, 2000.

REFERENCE BOOKS:

1. Graham Glass and King abls, “UNIX for Programmers and Users”, Pearson Education, 3rd edition, 1998.
2. M. J. Rochkind, “Advanced UNIX Programming”, Pearson Education, 2nd edition, 2004.
3. IEEE Transactions on Networking (IEEE TON)
4. ACM Transactions on Networking (ACM TON)

B18CS7043	C# and .Net	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Programming for problem solving [B18CS1030] and Object-Oriented Programming [B18CS2030].

Course Description:

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

Course Objectives:

The objectives of the course are to:

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

Course Outcomes:

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

CO1: Identify the basic components of the .NET Framework.

CO2: Develop a progam using C# data types for real world applications.

CO3: Make use of various interface techniques to invoke interface Members at the object Level

CO4: Apply exception handling mechanisms of C# for real world applications.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3	-

CO3	**3**	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

UNIT - 1

Introducing C# and .NET Platform: The Building Block of the .NET Platform (CLR, CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of.NET Binaries (aka Assemblies), the Role of the Common Intermediate Language, The Role of .NET Type Metadata, The Role of the assembly Manifest, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime.

UNIT - 2

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

UNIT - 3

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

UNIT - 4

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

Self-learning component:

Basics of Garbage Collection, Finalization a Type, the Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, the System. GC Type.

TEXT BOOKS

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

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

REFERENCE BOOKS:

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

2. IEEE Transactions on Computers

3. ACM Transactions on Algorithms

B18CS7044	Natural Language Processing	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Finite Automata and Formal Language [B18CS5010] and Artificial Intelligence

Course Description

The course provides the basics of Natural-language processing (NLP), which is an area of computer science and artificial intelligence concerned with the interactions between computers and human (natural) languages, in particular how to program computers to fruitfully process large amounts of natural language data. Natural language processing (NLP) is the ability of a computer program to understand human language as it is spoken. NLP is a component of artificial intelligence (AI). Challenges in natural-language processing frequently involve speech recognition, natural-language understanding, and natural-language generation.

Course Objectives:

The objectives of this courses are to:

1. Explain the different linguistic components in a given sentence.
2. Describe the features of automatic Speech Recognition.
3. Demonstrate the design of a parse tree using context free grammar for a given sentence.
4. Illustrate the semantic and pragmatic interpretation.

Course Outcomes (Cos)

Upon completion of this course, the student should be able to:

CO1: Identify the different linguistic components in a given sentence.

CO2: Develop a program for implementing automatic Speech Recognition

CO3: Create a parse tree using context free grammar for a given sentence.

CO4: Apply the semantic and pragmatic interpretation.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO2	2	3	2	3	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	3	2	-	-	-	-	-	-	-	3	3	-
CO4	3	3	1	3	2	-	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT -1:

Morphology and part-of speech processing: Introduction -Regular Expressions and Automata- Non-Deterministic FSAs. Tranducers -English Morphology - Finite-State Morphological Parsing - Porter Stemmer - Tokenization- Detection and Correction of Spelling Errors. N-grams - Perplexity - Smoothing - Interpolation - Backoff. Part-of- Speech Tagging - English Word Classes - Tagsets - Rule-Based - HMM - Transformation-Based Tagging - Evaluation and Error Analysis.

UNIT - 2:

Speechprocessing: Phonetics-Articulatory Phonetics-Phonological Categories-Acoustic Phonetics and Signals-Speech Synthesis-Text Normalization-Phonetic and Acousti cAnalysis-DiphoneWaveformsynthesis-Evaluation-Automatic Speech Recognition-Architecture- MFCC vectors - Acoustic Likelihood Computation - Evaluation. Triphones -Discriminative Training-Modeling Variation.Computational Phonology-Finite-State Phonology.

UNIT - 3:

Syntax analysis: Formal Grammars of English - Constituency - Context-Free Grammars - Grammar Rules - Treebanks - Finite-State and Context-Free Grammars - Dependency Grammars. Syntactic Parsing - Parsing as Search - Ambiguity - Dynamic Programming Parsing Methods -CKY- Earley and Chart Parsing-Partial Parsing-Evaluation. Statistical Parsing - Probabilistic Context-Free Grammars - Probabilistic CKY Parsing of PCFGs -Probabilistic Lexicalized CFGs -Collins Parser. Language and Complexity

UNIT - 4:

Semantic and pragmatic interpretation: Representation of Meaning-Desirable Properties- Computational Semantics -Word Senses - Relations Between Senses - WorldNet - Event Participants-PropositionBank-Frame Net--Metaphor.Computational Lexical Semantics- Word Sense Disambiguation.

Applications: Information Extraction - Named Entity Recognition - Relation Detection and Classification - Temporal and Event Processing - Template-Filling, Properties of Human Conversations - Basic Dialogue Systems - VoiceXML - Information- State and Dialogue Acts, Machine Translation-Issues in Machine Translation-Classical MT and the Vauquois Triangle- Statistical MT - Phrase-Based Translation Model.

Self-learning Components:

Syllabification - Learning Phonology and Morphology, Summarization - Single and Multi- Document Summarization - Focused Summarization - Evaluation. Dialog and Conversational Agents, Alignment in MT - IBM Models -Evaluation

TEXTBOOKS:

1. Jurafsky and Martin, “Speech and Language Processing”, Pearson Prentice Hall,Second Edition, 2008.
2. Christopher D. Manning and Hin richSchütze, “Foundations of Statistical Natural Language Processing”, MIT Press, First Edition,1999.

REFERENCE BOOKS:

1. Stevan Bird, “Natural Language Processing with Python”, Shroff, 2009. 4. James Allen, “Natural Language Understanding”, Addison Wesley, Second Edition, 2007.
2. Nitin Indurkhya, Fred J. Damerau, “Handbook of Natural Language Processing”, (Chapman&Hall/CRC Machine Learning & Pattern Recognition), Second Edition, 2010.
3. Alexander Clark, Chris Fox, Shalom Lappin, “The Handbook of Computational Linguistics and Natural Language Processing”, Wiley-Blackwell, Second edition,2012.
4. IEEE/ACM Transactions on Audio, Speech, and Language Processing.
5. Elsevier Journal of Computer Speech and Language.
6. Springer Journal of Natural Language Processing.

B18CS7051	Data Science using R	L	T	P	C
Duration:14Wks		3	0	0	3

Pre-requisites:

Probability and statistics (B18CS2010), Programming for problem solving (B18CS1030)

Course Description

R is rapidly becoming the leading language in data science and statistics. Today, R is the tool of choice for data science professionals in every industry and field. Whether the person is full-time number cruncher, or just the occasional data analyst, R will suit their needs. Predictive analysis will help in creating predictive models to solve real life problems.

Course Objectives:

1. Discuss the basics of R programming.
2. Demonstrate the use of Control Structures, Functions.
3. Illustrate the use of features of Graphics package in real world applications.
4. Describe the different models with respect to predictive analysis.

Course Outcomes (Cos):

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

CO1: Make use of Control structures and functions for real world applications.

CO2: Apply the R graphics features for the given real-world applications.

CO3: Solve real world problem using Regression Models.

CO4: Develop Predictive analysis model for the given real-world problem.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	3	1	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	2	1	3	2	-	-	-	-	-	-	-	-	3	-
CO 3	2	1	1	1	2	-	-	-	-	-	-	-	3	3	-
CO 4	3	2	3	1	2	-	-	-	-	-	-	-	-	-	-

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

Course Contents

Unit - 1

History and overview of R: R nuts and bolts, Getting Data In and Out of R, Interfaces to the Outside World, Subsetting R Objects,

Unit - 2

Managing Data Frames with the dplyr package, Control Structures, Functions, Loop functions

Unit - 3

R Graphics: Quickly exploring data, Bar graphs: Making a Basic Bar Graph, Grouping Bars Together, Making a Bar Graph of Counts, Using Colors in a Bar Graph, Line graphs: Making a Basic Line Graph, Adding Points to a Line Graph, Making a Line Graph with Multiple Lines, Changing the Appearance of Lines, Changing the Appearance of Points, Making a Graph with a Shaded Area, Scatter plots: Making a Basic Scatter Plot, Grouping Data Points by a Variable Using Shape or Color, Using Different Point Shapes, Mapping a Continuous Variable to Color or Size, Dealing with Overplotting.

Unit - 4

Predictive analysis: Data preprocessing, Regression Models: Measuring performance in regression models, Linear Regression and its cousins: Linear regression, Nonlinear Regression Models: Neural networks.

Self-learning Component:

Creating own datasets, functions and packages in R and using packages in R; Executing linear model for example data set; Creating Neural Networks for example data set;

TEXT BOOKS

1. Roger D. Peng, “R Programming for Data Science”, Leanpub, 2015
2. Winston Chang, “R Graphics Cookbook Practical Recipes for Visualizing Data”, O'Reilly Media, 2012
3. Kuhn, Max, Johnson and Kjell, “Applied Predictive Modeling”, Springer eBook.

REFERENCE BOOKS:

1. John Maindonald, W. John Braun, “Data Analysis and Graphics Using R - an Example Based Approach”, 3rd Edition, Cambridge University Press, 2010. (Unit 1 & 2)
2. Johannes Ledolter, “DATA MINING AND BUSINESS ANALYTICS WITH R”, WILEY, 2013. (Unit3)
3. W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, Notes on R: A Programming Environment for Data Analysis and Graphics Version 3.2.4 (2016-03-10) (Unit 4)
4. Springer, International Journal of Data Science and Analytics.
5. Elsevier, Computational Statistics & Data Analysis
6. IEEE, Transactions on Big Data.

B18CS7052	Deep Learning	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Machine Learning for Data Analytics [B18CS6010]

Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

Course Objectives:

The objectives of this course are to:

1. Explain the basic concepts of Deep Learning.
2. Describe supervised and unsupervised learning.
3. Demonstrate the use of a deep learning neural network in a real-world application.
4. Illustrate the use of deep learning techniques in neural networks and natural language processing

Course Outcomes:

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

CO1: Apply the basic concepts of mathematics to solve problems based on deep learning concepts.

CO2: Make use of suitable machine learning algorithms on real world problems (classification, clustering).

CO3: Utilize deep learning neural network model on real time applications like (face recognition, speech recognition).

CO4: Develop Recommender systems applications using CNN concepts of NLP.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	-	-	-	-	-	-	-	-	3	-	-

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

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

Course Contents:

UNIT - 1

Machine Learning Basics: Linear Algebra-Scalors, Vectors, Matrices and Tensors, Eigen Decomposition, SVD, PCA Probability and Information Theory-Probability Distribution, Conditional Probability, Chain Rule of Conditional Probability, Bayes' Rule.

UNIT - 2

Numerical Computation: Overflow, Underflow, Gradient Based Optimization, Constrained Optimization, Linear Least Squares, Machine Learning Basics- Learning Algorithms, Overfitting and Underfitting, Maximum Likelihood Estimation, Supervised and Unsupervised Learning Algorithms, Building Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT – 3

Deep Networks: Modern Practices-Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architectural Design, Back-Propagation Algorithm.

UNIT - 4

Convolutional Networks: Recurrent Neural Networks, Applications- Natural Language Processing, Recommender Systems.

Self-Learning Component:

Linear factor Models, Structured probabilistics Models, Monte-Carlo Methods, Deep generative Modles.

TEXT BOOK:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." First edition, An MIT Press book in preparation, 2015.

REFERENCE BOOKS:

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001.

2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.

3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.

4. Springer Journal of Machine Learning.

B18CS7053	Multimedia Computing & Networks	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Computer networks [B18CS5030] and Operating Systems [B18CS5040]

Course Description

This Course provides the knowledge of multimedia operating Systems and Quality of Service, compression standards, Network Protocols for multimedia communication and multimedia over wireless networks.

Course Objectives:

The objectives of this course are to:

1. Gain fundamental knowledge in understanding the basics of different multimedia networks and constrainsts for a good Quality of service in multimedia environment.
2. Demonstrate the process management and multimedia buffer management technique.
3. Explain the Network Services and Protocols for Multimedia Communications
4. Gain fundamental knowledge about multimedia communication across different networks.

Course Outcomes:

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

CO1: Identify the requirements and constraints for a good Quality of service in multimedia environment.

CO2: Make use of multimedia operating systems concepts to solve given real world application.

CO3: Develop Internet Telephony using Network Services and Protocols for effective Multimedia Communications.

CO4: Analyze the performance of the multimedia data transfer protocols used for Real world application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	3	2	3	1	1	-	-	-	-	-	3	-	-
CO2	2	2	3	2	3	1	-	-	-	-	-	-	-	3	-
CO3	3	2	3	1	3	1	1	-	-	-	1	-	3	3	-
CO4	3	2	3	1	2	1	1	-	-	-	-	-	-	-	-

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

Course Content:

UNIT - 1:

Introduction – Inter disciplinary 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 - 2:

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.

UNIT - 3:

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

UNIT - 4:

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.

Self-Learning component:

Social Media Sharing- Representative Social Media Services, User-Generated Media Content Sharing, Media Propagation in Online Social Networks

TEXT BOOKS

1.Li, Ze-Nian, Drew, Mark S., Liu, Jiangchuan, “Fundamentals of Multimedia”, Springer, First edition, 2014.

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

REFERENCE BOOKS:

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

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

3. IEEE, IEEE Transactions on Multimedia.

4. ACM, ACM Transactions on Multimedia Computing, Communications, and Applications

5. Elsevier, Elsevier Journal on Multimedia Computing. Springer, Springer Journals on Communication Networks

B18CS7054		L	T	P	C
Duration :14 Wks	Business Intelligence and Process Management	3	0	0	3

Prerequisites:

Database Management Systems [B18CS4030]

Course Description

Business Intelligence and Process Management (BPM) offers many challenges for software developers and scientists. This course introduces the business intelligence process management concepts, where a student gains overview of all aspects of business intelligence and process modelling, business process architectures and business process methodologies.

Course Objectives

1. Identify the tools and techniques of business intelligence required addressing a real-world problem.
2. Illustrate the use of data integration and extraction processes to derive meaningful information from the data collected from varioius sources.
3. Apply business intelligence to database and other enterprise systems.
4. Explain Business Process Management architectures and components of business process methodology

Course Outcomes (Cos):

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

CO1: Choose the concepts of Business Intelligence (BI) to be used fordata intergration and extraction process.

CO2: Apply Data warehousing concepts for Business Intelligence (BI) applications.

CO3: Identify legal and privacy issues to develop Business Intelligence applications.

CO4: Analyse different Business Process Management architectures and components of business process methodology for real time appliations.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	1	-	2	-	-	-	-	1	1	1	3	-	-
CO 2	3	2	3	2	-	-	-	-	-	-	3	-	-	3	-
CO 3	3	3	2	2	-	3	3	-	-	1	2	1	3	3	-

CO 4	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**-**	**-**

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

Course Content:

UNIT - 1:

Introduction to Business Intelligence: Overview; Changing Business Environments and computerized decision support, A framework for Business Intelligence (BI), Why a BI Program?, Transaction processing vs. Analytic processing, Successful BI Implementation, Major Tools and Techniques of BI.

UNIT - 2:

Data Warehousing: Definitions and concepts, Process Overview, Architectures, Data Integration & the Extraction, Transformation, & Load (ETL) Process, Development, Implementation Issues, Real-Time data warehousing, Security Issues, Case Studies and Examples.

UNIT- 3:

Business Intelligence Implementation: Integration & Emerging Trends: Overview, BI and Integration Implementation, Connecting BI Systems to database & other enterprise systems, On- demand BI, Issues of Legality, Privacy and Ethics, Emerging topics in BI: An Overview.

UNIT- 4:

Business Process Management Architectures and Methodology: Business Process Management Architectures: Workflow Management Architectures; Flexible Workflow Management; Web Services and their Composition; Advanced Service Composition. Business Process Methodology: Methodology Overview; Strategy and Organization; Survey; Design Phase; Platform Selection; Implementation and Testing; Operation and Controlling Phase.

Introduction to Robotics Process automation (RPA), RPA abilities, RPA Tools.

Self-learning component:

Tableau Tool and SPSS tool, Business Process Choreography Design and Implementation; Service Interaction Patterns

TEXT BOOKS

1. E. Turban, R. Sharda, D. Delen, David King, Business Intelligence, 2nd ed. Pearson India, 2010.
2. David Loshin, Business Intelligence: The Savvy Manager's Guide, Getting Onboard with Emerging IT, Morgan Kaufmann, First edition, 2003.
3. Mathias Weske, Business Process Management, Springer, ebook, 2007

REFERENCE BOOKS:

1. Marlon Dumas et. al., Fundamentals of Business Process Management, Springer, ebook, 2012.
2. Van der Aalst, Process Mining: Discovery, Conformance and Enhancement of Business Processes, Third edition, 2011.

B18CS7061	Human Computer Interaction	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming with Java [B18CS3030], Computer Graphics and Animation (B18CS7062)

Course Description:

This course presents the foundations of Human Computer Interaction (HCI). The contents are structured into phases comprising: Basic definitions and motivations of HCI, interaction paradigms, design principles and models, User-centred design methods comprising user studies, design approaches for interfaces and interaction, evaluation methods and techniques for data analysis, Research frontiers of HCI, including accessibility, universal design, and pervasive computing (ubiquitous, mobile and wearable computing).

Course Objectives:

The overall objective of the Course is as follows:

1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
2. Describe typical human-computer interaction (HCI) models and styles, as well as various HCI paradigms.
3. Demonstrate the use of an interactive design process and universal design principles in designing HCI systems.
4. Illustrate the use of different evaluation methods.

Course Outcomes (Cos):

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

CO1 : Identify the suitable positioning and pointing device to be used to work with the given application.

CO2 : Develop the user interface by Selecting an effective style for the given realworldapplications.

CO3 : Make use of different UI design rules to develop a user interface for a real-world application.

CO4 : Compare the different evaluation techniques used to measure the quality of User Interface.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	2	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	3	3	-	-	-	-	-	-	-	3	3	-

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

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

Course Content:

UNIT- 1

Introduction to Human and the Computer: Human: Input-output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks.

UNIT -2

The interaction and Paradigms: Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction. Paradigms: Paradigms for interaction. Interaction design basics: The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.

UNIT- 3

HCI in the software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping. Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Universal designs.

UNIT- 4

Evaluation techniques: Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method.

Self-learning component:

Designing user support systems, Ubiquitous computing applications research, Hypertext, multimedia and the World Wide Web.

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale, Human-Computer Interaction. 3rd Edition. Prentice Hall, 2004.

2. Julie A. Jacko, Human-Computer Interaction Handbook, 3rd Edition, CRC Press, 2012.

3. Ben Shneiderman, Catherine Plaisant, Designing the User Interface, 6th Edition, Addison Wesley, 2017.

REFERENCE BOOKS:

1. Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser Research Methods in Human- Computer Interaction, Wiley, Second edition, 2010.

2. ACM, International Journal of Human-Computer Studies.

3. IEEE, Transactions on Human-Machine Systems.

4. Elsevier, International Journal of Human-Computer Studies.

B18CS7062	Computer Graphics and Animation	L	T	P	C
Duration :14Wks		2	0	1	3

Prerequisites:

Programming for Problem Solving [B18CS1030]

Course Description:

This course introduces techniques, algorithms and principles of interactive computer graphics and animation, this course also prepares for study in real-time rendering, realistic image synthesis, and computer animation.

Course Objectives:

Objectives of this course are to:

1. Explain the basic principles of 3-dimensional computer graphics using Software and Hardware.
2. Describe the basics of Geometric transformation systems.
3. Demonstrate the use of two and three-dimensional viewing pipeline.
4. Illustrate the use of Animation and Flash overview.

Course Outcomes (Cos):

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

CO1 : Develop interactive computer graphics programs using OpenGL

CO2 : Apply three dimensional transformations for a real world application

CO3 : Identify requirements and constraints of two and three dimensional viewing pipeline.

CO4 : Design Animations using ADOBE Flash for the given real world application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	2	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	3	-
CO4	2	1	2	2	3	1	-	-	-	-	-	-	-	-	-

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

Course Content:

UNIT - 1

Applications of computer graphics, A graphics system, Images: Physical and synthetic, Imaging Systems, The synthetic camera model, The programmer's interface, Graphics architectures, Graphics Programming: The Sierpinski gasket, Programming Two Dimensional Applications, The OpenGL API, Primitives and attributes, Color, Viewing, Control functions, The Gasket program, Polygons and recursion, The three dimensional gasket.

UNIT – 2

Interaction, Input devices, Display Lists, Programming Event Driven Input, Menus, Building Interactive Models, Animating Interactive Programs, Three-dimensional Primitives, Coordinate Systems, Rotation, Translation and Scaling, Transformation in Homogeneous Coordinates, Concatenation of Transformations, OpenGL Transformation Matrices, Modeling a Colored Cube (Program).

UNIT – 3

Classical and computer viewing, Positioning of the camera, Simple projections, Projections in OpenGL, Hidden surface removal, Parallel-projection matrices, Perspective-projection matrices, Projections and Shadows, Clipping; Line-segment clipping – Cohen Sutherland Clipping and Liang-Barsky Clipping; Polygon clipping; Clipping in three dimensions, Rasterization, Bresenham's algorithm.

UNIT – 4

Animation and Flash overview: Development of animation, Non-Computer and computer based animation, Flash basics, Flash Work Environment, drawing overview, creating text boxes, creating animation

Self-learning components:

Lighting and shading models, Tools for graphics and animation, VFX

TEXT BOOKS

1. Edward Angel, Interactive Computer Graphics A Top Down Approach with OpenGL, Addison- Wesley, 5th Edition,2008

2. Malay K. Pakhira, Computer Graphics and Animation, PHI Learning Pvt. Ltd., First edition, 2010

REFERENCE BOOKS:

1. Foley, Van Damn, Feiner and Hughes, Computer Graphics: Principles and Practice. Addison Wesley.

2. Modeling in Computer Graphics: Proceedings of the IFIP WG 5.10 Working Conference Tokyo, Japan, April 8-12, 1991 (IFIP Series on Computer Graphics) by Tosiyasu L Kunii

B18CS7063	Software Defined Networks and Network Function Virtualization	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Computer Networks (B18CS5030)

Course Description:

The course introduces the concepts of Software Defined Networks, how SDN works and SDN in other environments. It also describes OpenFlow which is used for open network switching experiments. The last section covers Network Function Virtualization, its architecture and some of the research challenges in the design of NFV.

Course Objectives:

The objectives of this course are to:

1. Discuss the significance of SDN.
2. Demonstrate the use of different types of software defined networks.
3. Illustrate the use of Openflow additions in a real-world application
4. Describe the virtual environment required to provide various services to users

Course Outcomes (COs):

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

CO1 : Identify the role of SDN in a given real world applications.

CO2 : Analyze the functions of different types of software defined networks

CO3 : Make use of Openflow additions in a real-world application

CO4 : Develop a virtual environment to provide various services to users

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	2	2	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	3	3	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	3	3	2	3	1	1	-	-	-	-	-	3	3	-

CO 4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Contents:

UNIT - 1:

Software Defined Networks – Introduction: Basic Packet-Switching Terminology, HistoricalBackground. The Modern Data Centre, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Can We Increase the Packet-Forwarding IQ?

Why SDN?: Evolution of Switches and Control Planes, Cost, SDN Implications for Research and Innovation, Data Centre Innovation, Data Centre 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 - 2:

How SDN Works: Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDNController, SDN Applications, Alternate SDN Methods and Conclusion.

SDN in Other Environments: 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 and Conclusion.

UNIT - 3:

The OpenFlow Specification: Chapter-Specific Terminology, OpenFlow Overview, OpenFlow 1.0and OpenFlow Basics, OpenFlow 1.1 Additions, OpenFlow 1.2 Additions, OpenFlow 1.3 Additions, OpenFlow Limitations and Conclusion.

UNIT - 4:

Network Function Virtualization: Introduction, History of Network Function Virtualization, NFVExamples and Related Work and Open Questions.

NFV Architecture: NFV Infrastructure (NFVI), Virtual Network Functions and Services, NFV Management and Orchestration (NFV MANO).

Business Model and Design Considerations: Business Model, NFV Design Considerations, NFV, SDN and Cloud Computing, NFV Standardization Activities, Collaborative NFV Projects, NFV Implementations.

Research Challenges: Management and Orchestration, Energy Efficiency, NFV Performance, Resource Allocation, Security, Privacy and Trust Modelling of Resources, Functions and Services and Research Directions in Selected NFV Use Cases.

Self-learning component:

Explore SDN in the data centre and also SDN applications.

TEXT BOOKS

1. Paul Göransson, Chuck Black, “Software Defined Networks - A Comprehensive Approach”, Morgan Kaufmann, 2014.
2. Rashid Mijumbi, Joan Serrat, Juan-Luis Gorricho, Niels Bouten, Filip De Turck, Raouf Boutaba, “Network Function Virtualization: State-of-the-art and Research Challenges”, IEEE COMMUNICATIONS SURVEYS & TUTORIALS, 2015.

REFERENCE BOOKS:

1. SiamakAzodolmolky, “Software Defined Networking with OpenFlow”, Packt Publishing Ltd, 2013.
2. Sreenivas Voruganti, Sriram Subramanian,” Software Defined Networking with OpenStack”, Packt Publishing Ltd, 2016.
3. Jim Doherty, “SDN and NFV Simplified”, Pearson Education, 2016.
4. Doug Marschke, Jeff Doyle, Pete Moyer, “Software Defined Networking: Anatomy of OpenFlow”, Lulu Publishing services, 2015

B18CS7064	Advanced Web Technology	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Web Application Development [B18CS7010], Programming with Java [B18CS3030].

Course Description:

This course covers features of HTML 5 and CSS 3, controls and web services of ASP.Net and database access with MYSQL, basics of AngularJS, basics of AJAX and JQuery AJAX library, basics of Ruby, controls and RESTFul web services. These concepts are used in the development of Client-Server technology.

Course Objectives

The objectives of this course are to:

1. Explain the features of HTML 5 and CSS-3.
2. Illustrate the use of ASP.Net and Angular JS as front end and MYSQL as backend in real world applications.
3. Demonstrate the use of AJAX and Ruby in real world applications.
4. Discuss the different RESTFul Web Services available for users.

Course Outcomes:

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

CO1 : Utilize the tags of HTML5 and CSS3 to create web pages for a real world application.

CO2 : Develop an agriculture website using ASP.Net and Angular JS for creating a front end and MYSQL as backend.

CO3 : Build a regular expression in ruby to Validate the phone no for its correctness.

CO4 : Design an application for making use of the different RESTFul Web Services available.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	3	2	-	-	-	-	-	-	-	3	-	-
CO 2	2	2	3	3	2	-	-	-	-	-	-	-	-	3	-
CO 3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	-

CO 4	**2**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

Course Content:

UNIT-1

HTML 5 and CSS-3: Basic HTML Structure, Text, Images, CSS Building Blocks, Working with Style Sheets-Creating an External Style Sheet, Linking to External Style Sheets, Creating an Embedded Style Sheet, Formatting Text with Styles, Layout with Styles.

UNIT-2

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

UNIT-3

Ruby and AJAX: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching. Basic communication techniques – XHR, AJAX with images, Dynamic script loading, Cache control, AJAX patterns-Communication control patterns – predictive fetch, page reloading, submission throttling, periodic refresh, and multi-stage download, Fallback patterns, AJAX libraries – JQuery, JSON.

UNIT-4

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

Self-learning Component:

Rails, Angular JS complete study.

TEXT BOOKS

1. Elizabeth Castro, Bruce Hyslop, HTML5 and CSS3, 7th Edition, Peachpit Press, 20l2

2. Robert W. Sebesta, Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

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

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

5. Leonard Richardson and Sam Ruby, RESTFul Web Services, lst Edition, O'Reilly publications, 2007.

REFERENCE BOOKS:

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

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

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

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

5. ACM Transactions on Internet Technology

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

7. ACM Transactions on Information Systems.

B18CS7071	Big Data Analytics	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming with Java (B18CS3030), Database Management System (B18CS4030)

Course Description:

This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Course Objectives:

1. Explain the concepts of Big Data and its Business Implications
2. Describe the features of Big-Data Analytics.
3. Demonstrate the use of features of Apache Hadoop Framework.
4. Discuss features of Pig andHive.

Course Outcomes (Cos):

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

CO1: Outline the concepts of Big Data and its Business Implications.

CO2: Apply the theories of Big Data Analytics in the domain of Data warehousing and Mining.

CO3: Develop a real-world application using features of Hadoop.

CO4: Make use of features of Pig and Hive for data analytics

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3	3	2	2	-	-	-	-	-	-	3	3	-	-
CO 2	3	3	3	3	3	-	-	-	-	-	-	3	-	3	-
CO 3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	-

CO 4	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

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

Course Contents:

Unit-1:

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, Terminologies used in Big Data Environments.

Unit-2:

Big Data Analytics-Where do we begin, what is Big Data Analytics, What Is Big Data Analytics ISN'T? Why this sudden hype around Big Data Analytics, Classification of Analytics, top challenges facing big data, why is big data analytics, Why is big Data Analytics Important, what kind of technologies are we looking toward to help meet the challenges posed by big data? Data Science, Few top analytical tools.

Unit-3:

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, Hadoop-Features of Hadoop. MapReduce Daemons, How MapReduce works, MapReduce Example, Interacting with Hadoop Ecosystem, Mapper, Reducer, Combiner, Partitioner.

Unit-4:

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, Introduction to HIVE, What is hive ,hive architecture, hive data types, hive file formats,HQL,UDF.

Self-learning component:

NoSQL, MongoDB, Cassandra, Yarn, Flume, Sqoop

TEXT BOOKS

1. Seema Acharya, Subhashini Chellappan, Big data and data Analytics, Wiley,2015.

2. O'Reilly, Hadoop The Definitive Guide, TomWhite,2012

REFERENCE BOOKS:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj: Big data, big analytics, Wiley,2013

2. P. Tan, M. Steinbach, V. Kumar, Introduction to Data Mining, Addison-Wesley,2005.

3. J. Han, M. Kamber, Data Mining: Concepts and Techniques, 2nd edition. MorganKaufmann 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

B18CS7072	Block chain Technology	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Computer Networks (B18CS5030) and Database management System (B18CS4030).

Course Description:

Blockchain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called blockchain. Blockchains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

Course Objectives:

1. Explain the basic concepts of Block chain technology.
2. Describe the features of Ethereum block chain technology.
3. Demonstrate the Smart Contract Basics interaction with users
4. Discuss different Block Chain Platforms that can be used in real world applications.

Course Outcomes:

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

CO1: Apply the features of Block chain technology in real world application.

CO2: Develop an application using Ethereum and solidity.

CO3: Design an application for making use of smart contract.

CO4: Make use of different blockchain platforms in real world application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	2	–	–	–	–	–	–	1	3	-	-
CO 2	3	3	2	3	2	–	–	–	–	–	–	1	-	3	-

CO 3	**2**	**3**	**3**	**2**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**1**	**3**	**3**	**-**
CO 4	**2**	**3**	**3**	**2**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**1**	**-**	**-**	**-**

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

Course Content:

Unit-1:

The Blockchain: Introduction, Types of Blockchain, Structure of a Block, Block Header, Block Identifiers: Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Trees and Simplified Payment Verification (SPV), Using Test Blockchains for Development.

Mining and Consensus: Introduction, Constructing the Block Header, Mining the Block, Proof- of-Work Algorithm, Target Representation, Successfully Mining the Block, Validating a New Block, Assembling and Selecting Chains of Blocks, Blockchain Forks,

Unit-2:

Technology on Ethereum: Ethereum Accounts, Ethereum Work, Decentralized Applications, Decentralized Autonomous Organizations. Ethereum Blockchain Development, Best Practices, Solidity: Structure, Basic Data Types & Statements, Specific Data Types, Data Structures, Access Modifiers & Applications

Unit-3:

Smart Contract Basics: Smart Contract Design, Smart Contract Life Cycle: Smart Contract interaction with Users and Enterprise Applications, Debugging Your Smart Contract, Smart Contract Validation, Run Ethereum Dapps in your browser, Develop a simple smart contract.

Unit 4:

BlockChain Platforms: Alpha point distributed ledger programs, Corda, Chain Core, DomusTower, Hydra Chain, MultiChain, Hyperledger, Quorum, Stellar Blockchain Applications: Global Public Health, Genomics, Block Chain Health, bitcoin and cryptocurrency.

Self-learning component:

Distributed Ledger in Blockchain, Decentralized Applications.

TEXT BOOKS

1. Joseph J. Bambara Paul R. Allen," Block chain, A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill Education Professional, Second edition, 2018
2. Melanie Swan "Blockchain: Blueprint for a New Economy", O'Reilly Media, Third edition, Aug 2015.
3. Andreas M. Antonopoulos, Gavin Wood "Mastering Ethereum", O'Reilly Media, Inc., November 2018

REFERENCE BOOKS:

1. Imran Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smartcontracts“ Packt , 2nd edition 2018.
2. Jimmy Cooper, “Blockchain Blueprint: Guide to Everything You Need to Know About Blockchain Technology and How It Is Creating a Revolution “, Create Space Independent Publishing Platform, 2017.
3. Deepak Puthal; Nisha Malik; Saraju P. Mohanty; Elias Kougianos; Chi Yang “The Blockchain as a Decentralized Security Framework [Future Directions]” Volume: 7, Issue: 2, Pages: 18 – 21, Year: 2018.
4. Valentina Gatteschi; Fabrizio Lamberti; Claudio Demartini; Chiara Pranteda; Víctor Santamaría” To Blockchain or Not to Blockchain: That Is the Question “Volume: 20, Issue: 2 Pages: 62 - 74 ,2018.
5. Tien Tuan Anh Dinh; Rui Liu; Meihui Zhang; Gang Chen; Beng Chin Ooi; Ji Wang “Untangling Blockchain: A Data Processing View of Blockchain Systems”, Volume: 30, Issue: 7, Pages: 1366 – 1385, Year: 2018.
6. Mingjun Dai; Shengli Zhang; Hui Wang; Shi Jin “A Low Storage Room Requirement Framework for Distributed Ledger in Blockchain” Volume: 6, Pages: 22970 – 22975, Year: 2018.
7. Ruiguo Yu, Jianrong Wang, Tianyi Xu, Jie Gao Yongli An Gong Zhang, And Mei Yu “Authentication With Block-Chain Algorithm and Text Encryption Protocol in Calculationof Social Network “, Volume: 5, pp: 24944 – 24951, 09 November 2017.
8. Ashiq Anjum; Manu Sporny; Alan Sill “Block chain Standards for Compliance and Trust” , Volume: 4, Issue: 4 ,Pages: 84 – 90,Year: 2017.
9. Morgen E. Peck; Samuel K. Moore “The blossoming of the blockchain”, Volume: 54, Issue: 10 Pages: 24 –25, Year: 2017.
10. Inderscience Journal of blockchain and cryptocurrency.
11. Ledger Journal of Cryptocurrency and Blockchain Technology.

B18CS7073	Cloud Security	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Cloud Computing and Big data(B18CS6020).

Course Description:

Cloud security is an evolving sub-domain of computer security, network security, and, more broadly, information security. It refers to a broad set of technologies deployed to protect data, applications, and the associated infrastructure of cloud computing. This course provides a practical survey of both the principles and practice of cloud security. The emphasis of this course is on the underlying principles and techniques of cloud security with examples of how they are applied in practice.

Course Objectives:

The objectives of this course are to:

1. Describe the cloud security principles and mechanisms.
2. Demonstrate the building of cloud security infrastructure using computer programming and configuration skills.
3. Illustrate how to discover threats and vulnerabilities to cloud computing.
4. Explain how to fix cloud security weaknesses.

Course Outcomes (COs):

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

CO 1: Choose the suitable cloud deployment model for storage of data pertaining to given applications.

CO 2: Build a cloud security infrastructure using computer programming and configuration skills.

CO 3: Identify the securitymanagement issuesin the cloud with respect to SaaS ,IaaS and PaaS.

CO 4: Make use of various security policies for implementation of given real world problem.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	2	1	–	–	–	–	–	–	–	3	-	-

CO 2	**3**	**3**	**2**	**3**	**1**	–	–	–	–	–	–	–	-	**3**	-
CO 3	**3**	**2**	**3**	**2**	**2**	–	–	–	–	–	–	–	**3**	**3**	-
CO 4	**3**	**3**	**3**	**2**	**2**	–	–	–	–	–	–	–	-	-	-

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

Course Content:

Unit- 1

Introduction to Cloud Computing: Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level

Unit -2

Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security

Identity and Access Management: Trust Boundaries and IAM, Why IAM?, IAM Challenges, IAM Definitions, IAM Architecture and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice

Unit- 3

Security management in the cloud: Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch and Configuration Management

Privacy: What Is Privacy? What Is the Data Life Cycle? What Are the Key Privacy Concerns in the Cloud?

Who Is Responsible for Protecting Privacy? Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

Unit- 4

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance, Other Requirements, Cloud Security Alliance

Security-As-A-[Cloud] Service: Origins, Today's Offerings

Self-learning component:

Explore any one of the cloud (Amazon/Microsoft/Google/IBM/Cisco/Intel/Salesforce) for security.

TEXT BOOKS

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy-An Enterprise Perspective on Risks and Compliance,2009, O'Reilly.
2. Vic (J.R.) Winkler, Securing the Cloud: Cloud Computing Security Techniques and Tactics Syngress/Elsevier - 978-1-59749-592-9

REFERENCE BOOKS:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly Media, September 2009
2. Yeluri, Raghuram, Castro-Leon, Enrique, Building the Infrastructure for Cloud Security A Solutions View, Apress, 2014.
3. John Rhoton, Cloud Computing Protected: Security Assessment Handbook, 2013.
4. Ronal L Krutz, Russel Dean Vines, Cloud Security- A comprehensive Guide to Secure cloud Computing, Wiley.

B18CS7074	Bio-Informatics	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Knowledge of Data Science, Molecular Biology

CourseDescription:

This course introduces to the basic biology of modern genomics and the experimental tools that is used to measure it. Central Dogma of Molecular Biology is introduced and how next- generation sequencing can be used to measure DNA, RNA, and epigenetic patterns is done is covered. An introduction to the key concepts in computing and data science, how data from next- generation sequencing experiments are generated and analyzed are covered.

Course Objectives

1. Explain the concepts of biological databases.
2. Demonstrate the use of different search and Data Retrieval techniques.
3. Discuss the genome analysis, mapping and genomesequencing.
4. Illustrate the use of different gene prediction methods

Course Outcomes (Cos):

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

CO1: Outline the concepts of biological databases for data reterival.

CO2: Make use of search and data retrieval techniques for the given real world genome data .

CO3: Apply the genome analysis, mapping and genome sequencing to predict the gene.

CO4: Develop Gene Identification and Prediction models for given genome data.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	-	2	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	1	1	-	-	-	-	-	-	-	-	-	3	-
CO 3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	-

CO 4	**2**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

CourseContent:

Unit-1

Bioinformatics: An Introduction

Introduction, Historical Overview and Definition, Bioinformatics Applications, Major Databases in Bioinformatics, Data Management and Analysis, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology, Biological Databases Considerations.

Unit-2

Information Search and Data Retrieval:

Introduction, Electronic Libraries, Tools for Web Search, Data Retrieval Tools, Data Mining of Biological Databases.

Unit-3

Genome Analysis and Gene Mapping

Introduction, Genome Analysis, Genome Mapping, The Sequence Assembly problem, Genetic Mapping and Linkage Analysis, Physical Maps, Cloning the entire Genome, Genome Sequencing, Applications of Genetic Maps, Sequence Assembly Tools, Identification of Genes in Contigs, The Human Genome Project.

Unit-4

Gene Identification and Prediction

Introduction, Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods, Other Gene Prediction Tools.

Self-learning components:

Genome data management, sequencing the pairs of genomes, Hidden Markov Models, Phylogenetics.

TEXT BOOKS

1. S.C. Rastogi, N. Mendiratta, P. Rastogi, Bioinformatics Methods and Applications, 4th Edition, EEE, PHI, 2013. 2. Andreas D. Baxevanis, B. F. Francis Ouellette, BIOINFORMATICS A Practical Guide to the Analysis of Genes and Proteins, 2nd Edition, Wiley Interscience, 2001

REFERENCE BOOKS:

1. Lloyd Low, Martti Tammi, Bioinformatics-Practical-Generation-SequencingApplications,2017

2. T. R. Sharma, Genome-Analysis-Bioinformatics-Practical-Approach, I.K. International Publishing House Pvt. Ltd,2009

3. Genomic Data Science /Coursera

4. Introduction to Genomic Data Science /edX

5. Computational Genomics and Data Science Program, National Human Genome Research Institute.

6. The Analysis of Gene Expression Data: An Overview of Methods and Software, Giovanni Parmigiani, Elizabeth S. Garrett, Rafael A. Irizarry, Scott L.Zeger

VIII Semester
Syllabus

B18CS8031	Real Time Systems	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Operating systems [B18CS5040]

Course Description

This course familiarizes the fundamental problems concepts and approaches in the design and analysis of real-time systems. It also introduces various approaches, abstract models and terminologies for real-time scheduling. It also outlines various Priority-Ceiling Protocols used in resource sharing. Also gives the Impart knowledge of Real Time Operating Systems and Databases.

Course Objectives

The objectives of the course are to:

1. Explain the concepts of real-timesystems.
2. Demonstrate the use of algorithms in designing a real-timesystem.
3. Describe access Control in Multiple-Unit Resources to analyze, design and schedule the real- timesystems.
4. Discuss the characteristics of Real Time Operating Systems and Databases in newprojects.

Course Outcomes

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

CO1: Identify the fundamentals of Signal Processing and real-time systems.

CO2: Choose the appropriate algorithm to analyze and design a real-time system.

CO3: Make use of access Control in Multiple-Unit Resources to analyse, design and schedule the real-time systems.

CO4: Develop the applications using the characteristics of Real Time Operating Systems and Databases.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	3	-	-
CO2	3	3	2	3	2	-	-	-	-	-	-	3	-	3	-
CO3	3	3	2	2	1	-	-	-	-	-	-	2	3	3	-

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

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

CourseContent:

Unit1:

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 DataDependency.

Unit 2:

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 3:

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 4:

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.

Self-Learning Component:

Case study on features of VxWorks and QNX.

TEXTBOOKS:

1. Jane W. S. Liu, Real Time Systems, Pearson Education Publication2000.

2. Mall Rajib, “Real Time Systems”, Pearson Education,2007

REFERENCE BOOKS:

1. Albert M. K. Cheng, “Real-Time Systems: Scheduling, Analysis, and Verification”, Wiley,2003

2. Springer, International Journal of Time-Critical Computing Systems

3. Inderscience, International Journal of Embedded and Real-Time Communication Systems

4. Research Science Press, International Journal of Embedded Systems and Computer Engineering.

B18CS8032	Innovation and Entrepreneurship	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

NIL

Course Description:

Students will develop skills for evaluating, articulating, refining, and pitching a new product or service offering, either as a start-up business or a new initiative within an existing firm. This course is appropriate for all students interested in innovation and design as necessary components of new businesses today. The aims to acquaint the students with challenges of starting new ventures and enable then to investigate, understand and internalize the process of setting up a business.

Course Objectives (Cos):

The objectives of this course are to:

1. Explain the basics of Entrepreneurship.
2. Demonstrate the use of different Business Models and Planning for Business.
3. Describe different Operations and Management techniques required for a business
4. Discuss various sources of finance to establish a business.

Course Outcomes (Cos):

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

CO1: Outline the basics of Entrepreneurship to identify key startup ideas

CO2: Make use of different Business Models and Planning for establishing a Business.

CO3: Apply the different Operations and Management techniques in setting up a new venture.

CO4: Identify the various sources of finance to establish a business.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	1	1	-	-	2	2	2	3	-	-
CO2	1	2	1	-	2	1	1	-	-	2	2	2	-	3	-
CO3	1	1	1	-	2	1	1	-	-	2	2	2	3	3	-
CO4	1	1	1	-	-	1	1	-	-	2	2	2	-	-	-

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

Course Contents:

Unit 1

Basics of Entrepreneurship: Concept, knowledge and skills requirement; characteristic of successful entrepreneurs; role of entrepreneurship in economic development; entrepreneurship process; factors impacting emergence of entrepreneurship; managerial vs. entrepreneurial approach and emergence of entrepreneurship.

Unit 2

Starting the venture and Developing Successful Business Ideas: generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study: market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors; Writing a Business Plan, Industry and Competitor Analysis, Developing an Effective Business Model

Unit 3

Functional plans for Managing and Growing an Entrepreneurial Firm: Marketing plan – marketing research for the new venture, steps in preparing marketing plan, contingency planning; organizational plan: form of ownership, designing organization structure, job design, manpower planning; Financial plan: cash budget, working capital, Performa income statement Performa cash flow, perform balance sheet, break even analysis, Preparing for and evaluating the challenges of Growth, Strategies for Firm Growth, Franchising.

Unit 4

Sources of finance: Debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; legal issues: intellectual property rights patents, trademarks, copy rights, trade secrets, licensing; franchising

Self-learning component:

The role of ICT and innovation in enhancing organizational performance

TEXT BOOKS

1. Entrepreneurship Development, Hisrich, Robert D., Michael Peters and Dean Shepherded, Tata McGraw Hill, ND,2007.

2. Entrepreneurship, Brace R., and R., Duane Ireland, Pearson Prentice Hall, New Jersy (USA),2015.

REFERENCE BOOKS:

1. Entrepreneurship, Lall, Madhurima, and Shikha Sahai, Excel Book, New Delhi, 2008.

2. Entrepreneurship Development and Small Business Enterprises, Charantimath, Poornima, Pearson Education, New Delhi.

B18CS8033	Ethical Hacking and IT Security Evaluation	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

Cryptography and Network Security [B18CS7020]

Course Description

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

Course Objectives:

The objectives of this course are to:

1. Explain the concepts of Ethical Hacking.
2. Describe the different techniques used in Ethical hacking and security.
3. Discuss different Ethical hacking tools used to perform various activities.
4. Demonstrate the intrusion detection and prevention systems (IDPS).

Course Outcomes:

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

CO1: Outline the basic concepts of Ethical Hacking.

CO2: Identify the Enumeration Techniques and tools to be used for the given real-world applications.

CO3: Make use of the different Ethical hacking and security tools and techniques in the given application.

CO4: Develop an intrusion detection and prevention system (IDPS) for the given application.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	3		2	-	3	-	-	-	-	-	3	-	-
CO2	-	-	3		2	-	3	-	-	-	2	-	-	3	-
CO3	-	-	3		2	-	3	-	-	-	-	-	3	3	-
CO4	-	-	3		2	-	3	-	-	-	-	-	-	-	-

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

Course Content:

UNIT - 1:

Introduction to hacking: Introduction to Hacking, Importance of Security, Elements of Security, Phases of an Attack, Types of Hacker Attacks, Hacktivism, Vulnerability Research,

Footprinting: Introduction to Footprinting, Information Gathering Methodology, Footprinting Tools, WHOIS Tools, DNS Information Tools, Locating the Network Range, Meta Search Engines.

UNIT - 2:

Scanning and enumeration: Introduction to Scanning, Objectives, Scanning Methodology, Tools, Introduction to Enumeration, Enumeration Techniques, Enumeration Procedure, Tools.

System hacking: Introduction, Cracking Passwords, Password Cracking Websites, Password Guessing, Password Cracking.

UNIT - 3:

Programming for security professionals: Programming Fundamentals, C language, HTML, Perl,Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities, Countermeasures, Linux OS Vulnerabilities, Tools for Identifying Vulnerabilities, Countermeasures.

UNIT - 4:

Penetration testing: Introduction, Security Assessments, Types of Penetration Testing- Phases ofPenetration Testing, Tools, Choosing Different Types of Pen-TestTools, Penetration Testing Tools

Self-learning component:

Password Cracking Tools, Password Cracking Counter measures, Escalating Privileges, Executing Applications, Key loggers

and Spyware.

TEXT BOOKS

1. Ec-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Delmar Cengage Learning, First edition, 2009.
2. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, First edition, 2012.

REFERENCE BOOKS:

1. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Syngress Media, Second Revised Edition, 2013.
2. Jon Erickson, “Hacking: The Art of Exploitation”, No Starch Press, Second Edition, 2008
3. David Kennedy, Jim O'gorman, Devon Kearns, Mati Aharoni, “Metasploit: The Penetration Tester's Guide”, William Pollock, First edition, 2011.
4. Vivek Ramachandran, “BackTrack 5 Wireless Penetration Testing Beginner's Guide”, Open source, First edition, September 2011.
5. IBM Systems Journal - End-to-end security, ebook.

B18CS8034	Cognitive Science and Computing	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Physics [B18CS2020], Object Oriented Programming with Java [B18CS3030], Data Structures [B18CS3040].

Course Description:

Cognitive Science studies various aspects of the mind, such as perception, memory, learning, and reasoning. Cognitive Science is a highly interdisciplinary field of study at the intersection of philosophy, psychology, computer science, neuroscience, linguistics, and anthropology. Cognitive Computing is an experimental process and this course will help the students to understand the overview of deep learning neural networks, general machine learning, and natural language processing. Cognitive computing is closely associated and has significant overlap with the study of artificial intelligence, knowledge representation, linguistics, psychology, and neuroscience.

Course Objectives:

1. Explain the history of cognitive science andcognitive model building approach.
2. Demonstrate the use of cognitive approach and linguistic approach in a real-world application.
3. Illustrate the use of cognitive computing techniques in a real-world application.
4. Discuss the concepts of Deep Neural Networks and Natural Language Processing.

Course Outcomes (Cos):

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

CO1: Make use of cognitive model building approachin a real-world application.

CO2: Develop a real-world application by using cognitive approach and linguistic approach.

CO3: Apply cognitive computing techniques using Supervised and Unsupervised Learning.

CO4: Build the application to processthe given text data using Natural Language Processing.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	1	-	-	-	-	-	1	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	2	-	-	-	-	-	-	1	3	3	-

CO4	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

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

Course Contents:

UNIT- 1

Introduction: Exploring Inner Space: A Brave New World; what is Cognitive Science? Representation; Computation; the Interdisciplinary Perspective.

The Cognitive Approach I- History, Vision and Attention: Some History First-The Rise of Cognitive Psychology; The Cognitive Approach-Mind as an Information Processor; Modularity of Mind; Theories of Vision and Pattern Recognition; Theories of Attention; Evaluating the Model Building Approach, Introduction to IBM Watson.

UNIT -2

The Cognitive Approach and Linguistic Approach: The Cognitive Approach II: Memory, Imagery and Problem Solving; Types of Memory; Memory Models; Visual Imagery; Problem Solving The Linguistic Approach-Language and Cognitive Science: The Linguistic Approach-The Importance of Language; The Nature of Language; Language Use in Primates; Language Acquisition; Language Deprivation; Philosophy and Linguistics-The Linguistic Relativity Hypothesis; Cognition and Linguistics-The Role of Grammar; Neuroscience and Linguistics; Artificial Intelligence and Linguistics

UNIT- 3

Introduction to Cognitive Computing and Practical Applications: An Introduction to Cognitive Computing: Overview; An Overview of How the Human Brain Works; Introduction to Artificial Neural Networks; Symbolic Representation of Facts and Rules (Expert Systems); Symbolic Models for Natural Language Processing; The Public's Perception of Cognitive Computing and Artificial Intelligence.

Practical Applications of Cognitive Computing: Introduction to Supervised and Unsupervised Learning; Linear Regression; Backpropagation Neural Networks; Feature Engineering

UNIT- 4

Implementing Deep Neural Networks and Natural Language Processing: Using TensorFlow for Implementing Deep Neural Networks: Processing Cancer Data with a Backpropagation Network; Using Convolutional Deep Learning Networks for Text Classification. Tools and Techniques for Natural Language Processing: Introduction to the spaCY NLP Library; Using spaCY for Assigning Part of Speech Tags; Using spaCY for Entity Recognition; Introduction to the OpenNLP Library; Classification Example Using the OpenNLP Library; Training a New Categorization Model using Facebook's fast text

Self-learning components:

MATLAB and R Tool, Analogical Reasoning; Silhouettes and Object Constancy; Memory Effects; Conversational Pragmatics

TEXT BOOKS

1. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, SAGE Publications,

Third edition, 2006.

2. Mark Watson, Introduction to Cognitive Computing: A Guide for Individuals and Small Organizations, First edition, 2012. Ebook available at: https://leanpub.com/cognitive-computing/read.

REFERENCE BOOKS:

1. Judith S. Hurwitz, et. al., Cognitive Computing and Big Data Analytics, 1st Edition, WILEY, 2015
2. Wilson, Robert A., & Keil, Frank C. (eds.), The MIT Encyclopedia of the Cognitive Sciences (MITECS), MIT Press, Second edition, 2001
3. Bowerman, Melissa and Stephen C. Levinson, Language Acquisition and Conceptual Development, First edition, Cambridge University Press 2001
4. Springer Journals on Cognitive Science and Technology
5. Elsevier Journals of Cognitive systems Research. CO, PO & PSO MAPPING:

B18CS8035	Data Compression	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Data Structures [B18CS3040] Design and Analysis of Algorithms [B18CS4010]

Course Description:

This course provides an overview of classical and modern techniques and algorithms of various types data compression. It covers statistical and dictionary methods, lossless and lossy compression algorithms in graphics, video and audio compression. Understand the importance of multimedia in today's online and offline information sources and repositories. Understand how Text, Audio, Image and Video information can be represented digitally in a computer, so that it can be processed, transmitted and stored efficiently. Understand the possibility and limitations of multimedia data compression. Understand the text and image compression techniques. Understand the basic audio and video codingtechniques.

Course Objectives:

The objectives of the course are to;

1. Explain fundamentals of data compression and their applications
2. Demonstrate the use of lossless and lossy compression techniques
3. Discuss different file formats required for compressing image, sound and video.
4. Illustrate the use of different scalar quantization methods.

Course Outcomes (Cos):

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

CO1: Make use of lossless and lossy compression techniques for real world data.

CO2: Compare performance of Huffman and Arithmetic coding algorithms with respect to the given compressed data using both.

CO3: Apply different Dictionary Techniques to compress the given data.

CO4: Identify a suitable scalar quantization to compress the given real-world data.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	3	2	-	1	-	-	-	-	3	-	-
CO2	3	3	2	3	3	2	-	-	-	-	-	-	-	3	-
CO3	3	3	2	3	3	2	-	-	-	-	-	-	3	3	-
CO4	3	3	2	3	3	2	-	-	-	-	-	-	-	-	-

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

Course Content:

Unit-1

Introduction to Lossless Compression and Lossy Compression Mathematical Preliminaries for Lossless Compression, Test for Unique Decodability, Uniquely Decodable Codes, Prefix Codes,

Kraft MacMillan Inequality, Huffman Coding, Optimality of Huffman Codes, Average Length of Huffman Codes, Extended Huffman Codes, Non binary Huffman Codes, Adaptive Huffman Coding, Golomb Codes, RiceCodes, Tunstall Codes

Unit -2

Motivation for Arithmetic Coding, coding a Sequence, Generating a Tag, Deciphering the Tag, Generating a Binary Code, Uniqueness and Efficiency of the Arithmetic Code, Algorithm Implementation Issues, Issues related to Integer Implementation, Comparison of Huffman and Arithmetic coding.

Unit- 3

Dictionary Techniques: Static Dictionary Techniques, Adaptive Dictionary Techniques, Universal Compression, LZ, LZW, etc. algorithms. Mathematical preliminaries for Lossy Compression, Conditional Entropy, Average Mutual Information, Differential Entropy, Rate Distortion Theory, Compression Scheme in terms of Conditional Probabilities, Rate distortion function for various sources

Unit- 4

Scalar Quantization: Quantization Problem, Uniform Quantizer, Adaptive Quantization, Jayant Quantizer, Nonuniform Quantization, pdf Optimized Quantization, Companded Quantization, Entropy Coded Quantization

TEXTBOOKS:

1. Khalid Sayood, Introduction to Data Compression, 2nd Edition, Morgan Kaufmann Publishers

2. David Salomon, Data Compression: The Complete Reference, 2nd Edition, Springer.

3. Mark Nelson and Jean Loup Gailly, The Data Compression Book, 2nd Edition, BPB Publications

REFERENCE BOOKS:

1. Salomon.D, Motta, G. Handbook of Data Compression. (2010) Springer

2. The Data Compression Library—Source code.

Course Code	Course Title	Duration (Weeks)	Course Type	L	T	P	C	Hrs. /Wk.
B18CS8040	**Project Work Phase-2**	**16**	**HC**	**0**	**2**	**8**	**10**	**20**

Project work phase – 2, in 8th semester should have an outcome:

publication in a reputed National/International Journal or a patent filing to earn 2 credits

COURSE OUTCOMES:

On completion of project work the student will be able to

CO1. Demonstrate in-depth knowledge on the project topic

CO2. Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.

CO3. Design solutions to the chosen project problem.

CO4. Undertake investigation of project problem to provide valid conclusions.

CO5. Use the appropriate techniques, resources and modern engineering tools necessary for project work.

CO6. Apply project results for sustainable development of the society.

CO7. Understand the impact of project results in the context of environmental sustainability.

CO8. Understand professional and ethical responsibilities while executing the project work.

CO9. Function effectively as individual and a member in the project team.

CO10. Develop communication skills, both oral and written for preparing and presenting project report.

CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.

CO12. Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.

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

Project Work Evaluation Rubrics:

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
Review-1			
Selection of Topic (CO1)	Selected a latest topic through complete knowledge of facts and concepts	Selected a topic through partial knowledge of facts and concepts	Selected a topic through improper knowledge of facts and concepts
Analysis and Synthesis (CO2)	Thorough comprehension through analysis/ synthesis	Reasonable comprehension through analysis/ synthesis	Improper comprehension through analysis/ synthesis
Literature Survey (CO4)	Extensive literature survey with standard references	Considerable literature survey with standard references	Incomplete literature survey with substandard references

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
Ethical Attitude (CO8)	Clearly understands ethical and social practices.	Moderate understanding of ethical and social practices.	Insufficient understanding of ethical and social practices.
Independent Learning (CO9)	Did literature survey and selected topic with little guidance	Did literature survey and selected topic with considerable guidance	Selected a topic as suggested by the supervisor
Oral Presentation (CO10)	Presentation in logical sequence with key points, clear conclusion and excellent language	Presentation with key points, conclusion and good language	Presentation with insufficient key points and improper conclusion
Report Writing (CO10)	Status report with clear and logical sequence of chapters using excellent language	Status report with logical sequence of chapters using understandable language	Status report not properly organized
Continuous Learning (CO12)	Highly enthusiastic towards continuous learning	Interested in continuous learning	Inadequate interest in continuous learning
Review-2			
Analysis and Synthesis (CO2)	Thorough comprehension through analysis/ synthesis	Reasonable comprehension through analysis/ synthesis	Improper comprehension through analysis/ synthesis
Problem Solving (CO3)	Thorough comprehension about what is proposed in the literature papers	Reasonable comprehension about what is proposed in the literature papers	Improper comprehension about what is proposed in the literature
Literature Survey (CO4)	Extensive literature survey with standard references	Considerable literature survey with standard references	Incomplete literature survey with

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
			substandard references
Usage of Techniques & Tools (CO5)	Clearly identified and has complete knowledge of techniques & tools used in the project work	Identified and has sufficient knowledge of techniques & tools used in the project work	Identified and has inadequate knowledge of techniques & tools used in the project work
Project work impact on Society (CO6)	Conclusion of project work has strong impact on society	Conclusion of project work has considerable impact on society	Conclusion of project work has feeble impact on society
Project work impact on Environment (CO7)	Conclusion of project work has strong impact on Environment	Conclusion of project work has considerable impact on environment	Conclusion of project work has feeble impact on environment
Ethical attitude (CO8)	Clearly understands ethical and social practices.	Moderate understanding of ethical and social practices.	Insufficient understanding of ethical and social practices.
Independent Learning (CO9)	Did literature survey and selected topic with little guidance	Did literature survey and selected topic with considerable guidance	Selected a topic as suggested by the supervisor
Oral Presentation (CO10)	Presentation in logical sequence with key points, clear conclusion and excellent language	Presentation with key points, conclusion and good language	Presentation with insufficient key points and improper conclusion
Report Writing (CO10)	Status report with clear and logical sequence of chapters using excellent language	Status report with logical sequence of chapters using understandable language	Status report not properly organized
Time and Cost Analysis (CO11)	Comprehensive time and cost analysis	Moderate time and cost analysis	Reasonable time and cost analysis
Continuous learning (CO12)	Highly enthusiastic towards continuous learning	Interested in continuous learning	Inadequate interest in continuous learning

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
External Examination			
Selection of Topic (CO1)	Selected a latest topic through complete knowledge of facts and concepts	Selected a topic through partial knowledge of facts and concepts	Selected a topic through improper knowledge of facts and concepts
Analysis and Synthesis (CO2)	Thorough comprehension through analysis/ synthesis	Reasonable comprehension through analysis/ synthesis	Improper comprehension through analysis/ synthesis
Problem Solving (CO3)	Thorough comprehension about what is proposed in the literature papers	Reasonable comprehension about what is proposed in the literature papers	Improper comprehension about what is proposed in the literature
Literature Survey (CO4)	Extensive literature survey with standard references	Considerable literature survey with standard references	Incomplete literature survey with substandard references
Usage of Techniques & Tools (CO5)	Clearly identified and has complete knowledge of techniques & tools used in the project work	Identified and has sufficient knowledge of techniques & tools used in the project work	Identified and has inadequate knowledge of techniques & tools used in project work

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
Project work impact on Society (CO6)	Conclusion of project work has strong impact on society	Conclusion of project work has considerable impact on society	Conclusion of project work has feeble impact on society
Project work impact on Environment (CO7)	Conclusion of project work has strong impact on Environment	Conclusion of project work has considerable impact on environment	Conclusion of project work has feeble impact on environment
Ethical attitude (CO8)	Clearly understands ethical and social practices.	Moderate understanding of ethical and social practices.	Insufficient understanding of ethical and social practices.
Independent Learning (CO9)	Did literature survey and selected topic with little guidance	Did literature survey and selected topic with considerable guidance	Selected a topic as suggested by the supervisor
Oral Presentation (CO10)	Presentation in logical sequence with key points, clear conclusion and excellent language	Presentation with key points, conclusion and good language	Presentation with insufficient key points and improper conclusion
Report Writing (CO10)	Status report with clear and logical sequence of chapters using excellent language	Status report with logical sequence of chapters using understandable language	Status report not properly organized
Time and Cost Analysis (CO11)	Comprehensive time and cost analysis	Moderate time and cost analysis	Reasonable time and cost analysis
Continuous learning (CO12)	Highly enthusiastic towards continuous learning	Interested in continuous learning	Inadequate interest in

Rubric (CO)	Excellent (Wt = 3)	Good (Wt = 2)	Fair (Wt = 1)
			continuous learning

Internship/Skill Development / Global Certification Program

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 Objectives

1. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
2. To encourage teamwork.
3. To help students to gain exposure into industries.
4. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation

Course Outcomes (COs)

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

CO1	Demonstrate in-depth knowledge on the project topic
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.
CO3	Design solutions to the chosen project problem.
CO4	Undertake investigation of project problem to provide valid conclusions.
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.

CO6	Apply project results for sustainable development of the society.
CO7	Understand the impact of project results in the context of environmental sustainability.
CO8	Understand professional and ethical responsibilities while executing the project work.
CO9	Function effectively as individual and a member in the project team.
CO10	Develop communication skills, both oral and written for preparing and presenting project report.
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.

CO, PO & PSO MAPPING:

Course Outcomes	**Program Outcomes**														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO 3	-	-	3	-	-	-	-	-	-	-	-	-	3	3	3
CO 4	-	-	-	3	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	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 completion 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 and students have to earn the certificate based on their performances in terms of project assignment and aptitude. Student have to choose two Global certification courses.

Course Objectives

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 (COs)

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

CO1	Demonstrate in-depth knowledge on the project topic
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.
CO3	Design solutions to the chosen project problem.
CO4	Undertake investigation of project problem to provide valid conclusions.
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.
CO6	Apply project results for sustainable development of the society.
CO7	Understand the impact of project results in the context of environmental sustainability.
CO8	Understand professional and ethical responsibilities while executing the project work.
CO9	Function effectively as individual and a member in the project team.

CO10	Develop communication skills, both oral and written for preparing and presenting project report.
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.

CO, PO & PSO MAPPING:

Course Outcomes	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO 3	-	-	3	-	-	-	-	-	-	-	-	-	3	3	3
CO 4	-	-	-	3	-	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	3	3
CO6	-	-	-	-	-	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 certifications 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.

CAREER DEVELOPMENT AND PLACEMENT

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

- Willingness to learn
- Self motivation
- Team work
- Communication skills and application of these skills to real scenarios
- Requirement of gathering, design and analysis, development and testing skills
- Analytical and Technical skills
- Computer skills
- Internet searching skills
- Information consolidation and presentation skills
- Role play
- Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Computer Science & Engineering is efficient leaders of repute, who can deal the real time problems with a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building,

English proficiency, reasoning, puzzles, 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. The School of Computer Science & Engineering also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day-to-day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has recognized skill development and industry relationship as its very important activities. Therefore, the University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director has been established to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The 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, and universities abroad to facilitate greater opportunities of employability, students’ exchange programs for higher learning and for conducting certification programs.