REVA UNIVERSITY
Bengaluru, India

School of Computing and Information Technology

B.Tech. Computer Science and Information Technology

2022-26 Batch

HANDBOOK

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

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

HANDBOOK

First Year B. Tech. in Computer Science and Information Technology

2022-26

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-46966966

Rukmini Educational
Charitable Trust

www.reva.edu.in

Chancellor's Message

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

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

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

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

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

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

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor Message

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

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

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

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

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

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

Welcome to the portals of REVA University!

Dr.M.Dhanamjaya

Vice-Chancellor, REVA University

Director Message

I congratulate and welcome all the students to the esteemed school of Computing and Information Technology (CS& 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.). The Curriculum caters to local, national, regional and global developmental needs. Maximum number of courses are integrated with cross cutting issues relevant to professional ethics, global needs, human values, environment and sustainability. The courses in the curriculum focus on skill development, innovation and entrepreunership.

This handbook presents the B.Tech in Computer Science and Information Technology 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 B.Tech CSIT program. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Artificial Intelligence, Fuzzy Logic and Systems, Cognitive science and predictive analytics etc. Theoretical foundations of engineering, science, and Information Science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization.

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

1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Cloud Computing, Python/R Programming, NLP, IoT and Cloud security, 3) Short and long duration Internships 4) Opportunity to pursue MOOC course as per the interest in foundation and soft core courses, 5) Attain global and skill certification as per the area of specialization, 6) Self-learning components, 7) Experiential, practice, practical, hackathons, and project based learning, 8) Mini projects and major projects with research orientation and publication, 9) Soft skills training and 10) Platform for exhibiting skills in cultural, sports and technical activities through clubs and societies.

The school has well qualified faculty members in the various areas of computing and IT including cloud computing, security, IOT, AI, ML and DL, software engineering, computer networks, information technology, cognitive computing, block chain technology etc. State of art laboratories are available for the purpose of academics and research.

Dr. Mallikarjun M Kodabagi

Director, School of Computing and Information Technology

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RUKMINI EDUCATIONAL CHARITABLE TRUST

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

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

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

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

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines.

The curriculum of each programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive

measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

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

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced Trainers, Counsellors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Oklahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct

training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university.

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

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

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

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 standard.

Mission

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

Objectives

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

About School of Computing and Information Technology

The school has a rich blend of experienced and committed faculty who are well-qualified in various aspects of computing and information technology apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The School offers four full-time undergraduate programs, B.Tech in Computer Science and Engineering (Artificial Intelligence and Machine Learning), B.Tech in Computer Science and Information Technology, B.Tech in Computer Science and Systems Engineering, B.Tech in Information Science and Engineering and the following two postgraduate programs: M.Tech in Artificial Intelligence and M.Tech in Cybersecurity. In addition, the school has a research centre in which students can conduct cutting edge research leading to a PhD degree. Curriculum of both undergraduate and postgraduate programs have been designed through a collaboration of academic and industry experts to bridge the growing gap between industry and academia. This makes the program highly practical-oriented, and thus industry-resilient. The B.Tech programs aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world. The masters' degrees focus on quality research and design in the core and application areas of Artificial Intelligence and Information Technology to foster a sustainable world and to enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters' programs.

School Vision

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

School Mission

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

Quality Policy

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

1. Impart quality education by providing state of art curriculum, experimental learning, and state of the art labs.
2. Enhance skill set of faculty members through faculty development programs and interaction with academia and industries.
3. Inculcate the competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exhibition, Internship and Entrepreneurship Program.

4. Provide soft skill and skill development training for personality development and better placement.
5. Promote innovation and research culture among students and support faculty members for better research and development activity.

B. Tech Computer Science and Information Technology

Program Overview

Computer Science and Information Technology (CS & IT) encompasses a variety of topics that relates to computation and applications of computing like, development of algorithms, analysis of algorithms, programming languages, software design, computer hardware, e-commerce, business information technology, Data Analytics, Machine Learning, Block Chain Technology, Augmented Virtual Reality, Mobile Application Development, IoT, Wireless Sensor network, Web Technology. Computer Science and Information Technology (CS & IT) has roots in Electrical Engineering, Mathematics, and Linguistics. In the past Computer Science and information science were taught as part of mathematics or engineering departments and in the last 3 decades they are emerged as separate engineering fields. In the present information era (Knowledge era), the Computer Science and information technology program 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 just beginning.

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

The career opportunities for computer science and information technology graduates are plenty and growing. Programming and software development, Data Scientists, Data Analysts, information systems operation and management, telecommunications and networking, computer science research, web and Internet, graphics and multimedia, training and support, and computer industry specialists are some of the opportunities the graduates find. The School of Computing and Information Technology at REVA UNIVERSITY offers B. Tech., Computer Science and Information Technology, an undergraduate program to create motivated, innovative, creative and thinking graduates to fill ICT positions across sectors who can conceptualize, design, analyze, and develop ICT applications to meet the modern day requirements.

The B. Tech. in Computer Science and Information Technology 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 program, 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 program, advanced teaching and learning resources and experience of the faculty members with their strong connections with ICT sector makes this program unique.

Program Educational Objectives (PEO's)

After few years of graduation, the graduates of B. Tech CS&IT will:

- **PEO-1:** Pursue higher education in the core or allied areas of Computer Science and Information Technology.
- **PEO-2:** Have technical career in the core or allied areas of Computer Science and Information Technology or start entrepreneurial activity for the growth of the economy.
- **PEO-3:** Continue to learn and to adapt to ever changing technologies in the core or allied areas of Computer Science and Information Technology.

Program Outcomes (PO's)

On successful completion of the program, the graduates of B. Tech CS & IT program will be able to:

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering.
- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO-9: Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's)

On successful completion of the program, the graduates of B. Tech CS & IT program will be able to:

- **PSO-1:** Apply the knowledge of mathematics, Computer Science and Information Technology to solve complex problems in CS and IT.
- **PSO-2:** Analyze, design, develop solutions and conduct investigations in the domains of database, networks and security, system software and system administration.
- **PSO-3:** Apply appropriate techniques, use modern programming languages, tools, and packages for quality software development.

ACADEMIC REGULATIONS

B. Tech., (4 years) Degree Programs

(Applicable for the programs offered from 2022-23 Batch)

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

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – B. Tech., Degree Program 2022-23 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**

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

2. The Programs:

These regulations cover the following B. Tech., Degree programs of REVA University offered during 2022-23 under respective schools.

SL No.	Name of the School	Name of the Program
1	School of Civil Engineering	B Tech in Civil Engineering
2	School of Computing and Information Technology	B Tech Computer Science and Engineering (AI and ML)
		B Tech Computer Science and Information Technology
		B Tech in Information Science and Engineering
		B Tech in Computer Science and Systems Engineering
3	School of Computer Science and Engineering	B Tech in Computer Science and Engineering
		B Tech in Computer Science and Engineering (AI and DS)
		B Tech in Computer Science and Engineering (IoT, Cybersecurity and Blockchain)
4	School of Electrical and Electronics Engineering	B Tech in Electrical and Electronics Engineering
5	School of Electronics and Communication Engineering	B Tech in Electronics and Communication Engineering
		B Tech in Electronics and Computer Engineering
		B Tech in Robotics and Automation
6	School of Mechanical Engineering	B Tech in Mechanical Engineering
		B Tech in Mechatronics Engineering

3. Duration and Medium of Instructions:

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

3.2 The medium of instruction shall be English.

4. Definitions:

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

Every course offered will have three components associated with the teaching-learning process of the course, namely: L, T and P, 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 such as laboratory experiments, field studies, case studies, project based learning or course end projects and self-study courses that equip students to acquire the required skill component.

4.2 Classification of Courses

Courses offered are classified as: Core Courses, Foundation course, Open Elective Courses, Project work/Dissertation, Skill development courses, etc.

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

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

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

4.2.4 Soft Core Course (SC) (also known as Professional Elective Course): A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

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

4.2.6 Mandatory Non Credit Course (MC): These courses are mandatory for students joining B.Tech. Program and students have to successfully complete these courses before the completion of degree.

4.2.7 Project Work / Dissertation: Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems. The project will be conducted in two phases, phase-I, consists of literature survey, problem identification, formulation and methodology. In Phase-II , student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated.

4.2.8 Skill Development Course: It is a practice based course introduced in first year, second year and third year that lead to a certificate, diploma and advanced diploma, respectively.

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

5. Eligibility for Admission:

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

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B. Tech)	4 Years (8 Semesters)	Passed 10+2 examination with Physics and Mathematics as compulsory subjects, along with any one of the following subjects, namely, Chemistry, Bio-Technology, Computer Science, Biology, Electronics and Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology (B Tech)	3 Years (6 Semesters)	A. Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology. B. Passed B. Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. C. Provided that in case of students belonging to B. Sc.

Sl. No.	Program	Duration	Eligibility
			Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects. D. Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream. E. Provided further that student, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above. F. Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)
3	Bachelor of Technology (B Tech)		Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the University requirements.

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

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

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

6.3 The credit hours defined as below:

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

1 Credit = 14 credit hours spread over 16 weeks or spread over the semester.

The total duration of a semester is 20 weeks inclusive of semester-end examination.
The following table describes credit pattern

Table -2: Credit Pattern

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

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

7. Different Courses of Study:

Different **Courses of Study** are labeled as follows:

a. Core Course (CC)

b. Foundation Course (FC)

c. Hard Core Course (HC)

d. Soft Core Course (SC)

e. Open Elective Course (OE)

f. Skill Development Course (SDC)

g. Mandatory Non Credit Course (MC)

h. Project Work / Dissertation: A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated. These are defined under Section 4.2.7 of this regulation.

8. Credits and Credit Distribution

8.1 A candidate has to earn 166 credits for successful completion of B Tech degree with the distribution of credits for different courses with the credit distribution given in the scheme of study.

8.2 The concerned BOS based on the credits distribution shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self-study elective, as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC), Open Elective (OE) Skill Development Course (SDC).**

8.3 Every course including project work, practical work, field work, self-study elective should be entitled as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE)** or **Core Course** (**CC**) by the BoS concerned. However, as per AICTE, the credit distribution for various category of courses given below.

S. No.	Course Category	Abbreviation (AICTE)	Abbreviation (REVA)	Suggested breakup of credits (AICTE)	Credit breakup (REVA)
1	Humanities and Social Sciences including Management courses (HSMC)	HSMC	FC	12	9
2	Basic Science Courses	BSC	FC	25	20
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	ESC	FC	24	29
4	Professional core courses	PCC	HC	48	58
5	Professional Elective courses relevant to chosen specialization/branch	PEC	SC	18	15
6	Open subjects – Electives from other technical and /or emerging subjects	OE	OE	18	12
7	Project work, seminar and internship in industry or elsewhere	PROJ	HC	15	19
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]	MC	MC	-	-
9	Skill Development Courses (SDC)	-	SDC		06
TOTAL CREDITS				**160**	**168**

8.4 The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.A candidate can enrol for a maximum of 26 credits and a minimum of 16 credits per Semester. However, he / she may not successfully earn a maximum of 26 credits per semester. This maximum of 26 credits does not include the credits of courses carried forward by a candidate.

8.5 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 168 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students.

8.6 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 166 credits for the B Tech Degree program**.**

8.6.1 Add on Proficiency Diploma / Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree: a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different

discipline / subject in excess to 166 credits for the B Tech Degree program.

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

9 Assessment and Evaluation

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

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

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

9.3 The 50 marks of CIA shall comprise of:

Internal Assessment Test	40 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes, etc.	10 maarks

9.4 There shall be **two Internal Assessment Tests** are conducted as per the schedule announced below. **The Students' shall attend both the Tests compulsorily.**

- 1st test is conducted for 20 marks during **8th week** of the Semester;
- 2nd test is conducted for 20 marks during **15th week** of the of the Semester;

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

- Question paper of the **1st test should be based on first 50% of the total syllabus**;
- Question paper of the **2nd test should be based on remaining 50 % of the total syllabus**;
- An assignment must be designed to cover the entire syllabus

9.6 There shall be two Assignment / Project Based Learning / Field Visit / Quiz test carrying 10 marks covering the entire syllabus.

9.7 SEE for 50 marks practical exam shall be held in the 16th and 17th week of the semester.

9.8 SEE for 50 marks theory exam shall be held in the 18th 19th and 20th week of the semester and it should cover entire syllabus.

9.9 Internal test paper is set for a maximum of 40 marks to be answered in 1.5 hours duration (for 1 credit course, exam is conducted for 25 marks with a duration of 1 hour). A test paper can have 5 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totalling 10 marks. Students are required to answer any 4 main questions. Each question is set using Bloom's verbs. The questions must be set to assess the course outcomes described in the course document even with the choice is given in questions.

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

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

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

9.13 Internal assessment marks must be decided well before the commencement of SEE.

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

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

9.16 There shall be single evaluation by the examiners for each paper. However, there shall be moderation by one of the senior examiners, either internal or external.

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

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

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

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

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

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

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

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

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

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

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

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

9.25 Utilization of one or two credit online courses would be:

4 week online course – 1 credit

8 week online course / MOOC – 2 credits

12 week online course / MOOC – 3 credits

9.26 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below (for theory courses having Credits >=2).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Scaled down to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	40	20	9th week
2	Test -2	During 15th Week	Remaining 50%	40	20	16th Week
3	Assignment / Quiz - 1	Every week till Test-1	First 50%	10	05	9th Week
4	Assignment / Quiz - 2	Every week during Test-1 and Test-2	Remaining 50%	10	05	16th Week

5	SEE	18th to 20th Week	100%	100	50	20th Week

9.27 Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below (for theory courses having Credit 1).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	25	12.5	8th week
2	Test -2	During 15th Week	Remaining 50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

10 Assessment of Students Performance in Practical Courses

Lab courses are of two types: integrated labs and separate labs.

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

a. Knowledge of relevant processes;
b. Skills and operations involved;
c. Results / products including calculation and reporting

10.1 Assessment of lab courses

10.1.1 Assessment of Separate lab course

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

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	20 marks
	Total	**50 marks**

10.1.2 Assessment of integrated lab course

The 10 marks meant for Internal Assessment (IA) of the performance in carrying out Integrated lab course shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	05 marks
ii	Maintenance of lab records and performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	05 marks
	Total	**10 marks**

10.2 The 50 marks meant for Semester End Examination (SEE) in case of separate lab course shall be allocated as under:

i	Conduction of practical (experiment)	30 marks
ii	Write up about the experiment/tabulation/results/inference	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

Note: No Separate SEE for integrated lab course

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

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

For >= 2 credit courses

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

For 1 credit courses

i	IA (Performance of internal test to be conducted after completion of entire syllabus)	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	25 marks
	Total	**50 marks**

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

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

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

12. Evaluation of mandatory courses: Students should maintain minimum of 75% attendance to appear for SEE of Mandatory course. The SEE should be conducted in MCQ pattern and students should get minimum pass grade to obtain the degree. There is no internal assessment

13. Evaluation of **Skill Development Courses:** The concerned BoS shall recommend to conduct test/demo/viva-voce/MCQ to test the student knowledge.

14. Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50 , SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 30% (15 marks) in Semester End Examination (SEE) which is compulsory.

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

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

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

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

a. Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).
The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) = ∑(Ci x Gi) / ∑Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

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

Thus, **SGPA = 159 ÷ 19 = 8.37**

Illustration No. 2

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

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

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

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

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

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	21	6.83	21 x 6.83 = 143.43
2	23	7.29	23 x 7.29 = 167.67
3	22	8.11	22 x 8.11 = 178.42
4	24	7.40	24 x 7.40 = 177.6
5	22	8.29	22 x 8.29 = 182.38
6	24	8.58	24 x 8.58 = 205.92
7	22	9.12	22 x 9.12 = 200.64
8	10	9.25	10 x 9.25 =92.50
Cumulative	**168**		**1348.56**

Thus,

$$\boldsymbol{CGPA} = \frac{\mathbf{21\times6.83+23\times7.29+22\times8.11+24\times7.40+22\times8.29+24\times8.58+22\times9.12+10\times9.25}}{\mathbf{166}} = \frac{\mathbf{1346.58}}{\mathbf{168}} = 8.02$$

c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:
Percentage of marks scored = CGPA Earned x 10
Illustration: CGPA Earned 8.02 x 10=80.2

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

Classification of Results

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

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

Overall percentage=10*CGPA

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

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

14.2 Attendance Requirement

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

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

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

15. Re-Registration and Re-Admission:

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

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

16. Absence during Internal Test:

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

17. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective

semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

i **Grievance Committee:**

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

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

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the 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.

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

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

19. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 30% (15 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

20. Provision to Carry Forward the Failed Subjects / Courses:

The student who has failed in courses worth of 12 credits or less in odd and even semesters together shall move to next semester of succeeding year(s) of study till 8th semester. And he / she shall appear for Semester End examination of failed courses of previous semesters concurrently with odd semester end examinations and / or even semester end examinations of current year of study.

Case 1: A student who has failed in a maximum of 12 credits in 1st and 2nd semester together shall move to the 3rd semester of the succeeding year.

Case 2: A student who has failed in a maximum of 12 credits from semester 1 to 4 together shall move to the 5th semester of the succeeding year.

Case 3: A students who has failed in a maximum of 12 credits from semester 1 to 6 together shall move to the

7th semester of the succeeding year.

21. Re-evaluation of Answer Scripts and Announcement of Re-evaluation Results

After declaration of the results of programs within next 10 days, if any candidate wishes to apply for Photocopy/Revaluation (only theory courses), s/he shall apply to the Controller of Examinations, by paying the prescribed fees notified by the University from time to time. The photocopies of the said answer books shall be made available within next TEN working days after the last date prescribed for receipt of the application at the Office of the Controller of Examinations. Photocopies will not be issued for practical/drawing/audit courses.

22. Results of Re-Evaluation will be announced within TWENTY working days (except for third evaluation).

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

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

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

SCHEME OF INSTRUCTIONS (2022 – 2026 BATCH)

B. Tech CS & IT

I Semester (Chemistry Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE /MC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22AS0103	Multivariable Calculus & Linear Algebra	FC	3	0	0	3	3	50	50	100	BSC
2	B22AS0104	Engineering Chemistry	FC	3	0	0	3	3	50	50	100	BSC
3	B22AH0103	Communication Skills	FC	0	0	1	1	2	25	25	50	HSMC
4	B22CI0104	Programming with C	HC	3	0	0	3	3	50	50	100	ESC
5	B22ME0103	Elements of Mechanical Engineering	HC	3	0	0	3	3	50	50	100	ESC
6	B22EN0101	IoT and Applications	HC	1	0	1	2	3	50	50	100	ESC
7	B22ME0102	Design Thinking	HC	1	0	1	2	3	50	50	100	ESC
8	B22AS0105	Engineering Chemistry Lab	FC	0	0	1	1	2	25	25	50	BSC
9	B22CI0108	Programming with C Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22ME0104	Engineering Workshop	HC	0	0	1	1	2	25	25	50	ESC
TOTAL				**16**	**0**	**5**	**20**	**26**	**400**	**400**	**800**	
TOTAL SEMESTER CREDITS				**20**								
TOTAL CUMULATIVE CREDITS				**20**								
TOTAL CONTACT HOURS				**26**								
TOTAL MARKS				**800**								

II Semester (Physics Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22AS0203	Probability & Statistics	FC	3	0	0	3	3	50	50	100	BSC
2	B22AS0106	Physics for Computer Science	FC	3	0	0	3	3	50	50	100	BSC
3	B22EN0102	Introduction to Accounting	FC	1	0	0	1	1	25	25	50	HSMC
4	B22CS0104	Introduction to Data Science	HC	2	0	0	2	2	50	50	100	ESC
5	B22EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	0	3	3	50	50	100	ESC
6	B22ED0101	Elements of Civil Engineering and Engineering Mechanics	HC	3	0	0	3	3	50	50	100	ESC
7	B22ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4	50	50	100	ESC
8	B22AS0109	Physics for Computer science Lab	FC	0	0	1	1	2	25	25	50	BSC
9	B22CS0108	Data Science Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22EE0102	Basics of Electrical and Electronics Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22CI0201	Skill Development Course-1	SDC	0	0	2	2	4	50	50	100	SDC
12	B22AS0208	Tree Plantation in Tropical Region: Benefits and Strategic Planning	FC	1	0	0	1	1	25	25	50	HSMC
TOTAL				**18**	**0**	**6**	**24**	**30**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS				**24**								
TOTAL CUMULATIVE CREDITS				**44**								
TOTAL CONTACT HOURS				**30**								
TOTAL MARKS				**950**								

***Nomenclature*:** Lecture, **T:** Tutorial, **P:** Practical/Practice/Hands-on, **HC**: Hard Core, **SC**: Soft Core, **FC**: Foundation Core, **OE**: Open Elective, **SDC:** Skill Development Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination, **BSC**: Basic Science Course, **HSMC**: Humanities, Social science and Management Course, **ESC**: Engineering Science Course, **PCC**: Program Core Course, **PEC**: Professional Elective Course, **MC**: Mandatory Course, **PROJ**: Project work/Internship ***Note*:** SDC-1 will be hands-on based skill enhancement course that create expertise in the domain of respective engineering

III SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0301	Discrete Mathematics & Graph Theory	FC	3	0	0	3	3	50	50	100	BSC
2	B22EE0310	Universal Human Values	FC	2	0	0	2	2	50	50	100	HSMC
3	B22MEM301	Indian Constitution	MC	2	0	0	0	2	25	25	50	HSMC
4	B22EN0308	Technical Documentation	FC	1	0	0	1	1	25	25	50	HSMC
5	B22CI0301	Programming with Python	HC	3	0	0	3	3	50	50	100	ESC
6	B22CI0302	Data Structures	HC	3	0	0	3	3	50	50	100	ESC
7	B22CI0303	Analog and Digital Electronics	HC	3	0	0	3	3	50	50	100	ESC
8	B22CI0304	Theory of Computation	HC	4	0	0	4	4	50	50	100	ESC
9	B22CI0305	Programming with Python Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22CI0306	Data Structures Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22CI0307	Analog & Digital Electronics Lab	HC	0	0	1	1	2	25	25	50	ESC
TOTAL				**21**	**0**	**3**	**22**	**27**	**425**	**425**	**850**	
TOTAL SEMESTER CREDITS				**22**								
TOTAL CUMULATIVE CREDITS				**66**								
TOTAL CONTACT HOURS				**27**								
TOTAL MARKS				**850**								

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0401	Numerical Methods and Optimization Techniques	FC	3	0	0	3	3	50	50	100	BSC
2	B22CS0301	Professional Ethics	FC	2	0	0	2	2	50	50	100	HSMC
3	B22CI0309	Entrepreneurship	FC	1	0	0	1	1	25	25	50	HSMC
4	B22AS0403	Environmental Science	MC	2	0	0	0	2	25	25	50	BSC
5	B22CI0401	Computer Organization & Architecture	HC	3	0	0	3	3	50	50	100	ESC
6	B22CI0402	Design and Analysis of Algorithms	HC	3	1	0	4	5	50	50	100	ESC
7	B22CI0403	Database Management Systems	HC	3	0	0	3	3	50	50	100	ESC
8	B22CI0404	Programming with JAVA	HC	3	0	0	3	3	50	50	100	ESC
9	B22CI0405	Design and Analysis of Algorithms Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22CI0406	Database Management Systems Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22CI0407	Programming with JAVA Lab	HC	0	0	1	1	2	25	25	50	ESC
12	B22CI0408	Skill Development course –II (Full Stack Development)	SDC	0	0	2	2	4	50	50	100	ESC
TOTAL				**20**	**1**	**5**	**24**	**32**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS				**24**								
TOTAL CUMULATIVE CREDITS				**90**								
TOTAL CONTACT HOURS				**32**								
TOTAL MARKS				**950**								

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22XXO5XX	Open Elective -I (General)	OE	3	0	0	3	3	50	50	100	OE
2	B22ED0501	Indian Heritage and Culture	MC	2	0	0	0	2	25	25	50	HSMC
3	B22CI0501	Machine Learning	HC	3	0	0	3	3	50	50	100	ESC
4	B22CI0502	Computer Networks	HC	3	0	0	3	3	50	50	100	ESC
5	B22EJ0503	Web Technology & Applications	HC	3	0	0	3	3	50	50	100	ESC
6	B22CI0503	Operating Systems	HC	3	0	0	3	3	50	50	100	ESC
7	B22EXS5(01-03)	Professional Elective -I	SC	3	0	0	3	3	50	50	100	PEC
8	B22EXS5(04-06)	Professional Elective- II	SC	3	0	0	3	3	50	50	100	PEC
9	B22CI0504	Machine Learning Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22CI0505	Computer Networks Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22CI0506	Operating Systems Lab	HC	0	0	1	1	2	25	25	50	ESC
12	B22CI0507	Skill Development Course-III (Mobile Application Development)	SDC	0	0	2	2	4	50	50	100	ESC
TOTAL				**23**	**0**	**5**	**26**	**33**	**500**	**500**	**1000**	
TOTAL SEMESTER CREDITS				**26**								
TOTAL CUMULATIVE CREDITS				**116**								
TOTAL CONTACT HOURS				**33**								
TOTAL MARKS				**1000**								

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22XXO6XX	Open Elective -II (Multidisciplinary)	OE	3	0	0	3	3	50	50	100	OE
2	B22EJ0601	Big Data Analytics	HC	3	0	0	3	3	50	50	100	ESC
3	B22CI0601	Cloud Computing	HC	3	0	0	3	3	50	50	100	ESC
4	B22CI0602	Information and Network Security	HC	3	0	0	3	3	50	50	100	ESC
5	B22EXS6(01-03)	Professional Elective -III	SC	3	0	0	3	3	50	50	100	PEC
6	B22EXS6(04-06)	Professional Elective - IV	SC	3	0	0	3	3	50	50	100	PEC
7	B22EJ0602	Big Data Analytics Lab	HC	0	0	1	1	2	25	25	50	ESC
8	B22CI0603	Cloud Computing Lab	HC	0	0	1	1	2	25	25	50	ESC
9	B22CI0604	Information and Network Security Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22CI0605	Mini Project – Research Based	HC	0	0	2	2	4	50	50	100	PROJ
TOTAL				**18**	**0**	**5**	**23**	**28**	**425**	**425**	**850**	
TOTAL SEMESTER CREDITS				**23**								
TOTAL CUMULATIVE CREDITS				**139**								
TOTAL CONTACT HOURS				**28**								
TOTAL MARKS				**850**								

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22XXO7XX	Open Elective -III (MOOC)	OE	3	0	0	3	3	50	50	100	OE
2	B22XXO7XX	Open Elective –IV	OE	3	0	0	3	3	50	50	100	OE
3	B22EXS7(01-03)	Professional Elective -V	SC	3	0	0	3	3	50	50	100	PEC
4	B22CI0701	Skill Development course – IV / Global Certification / Internship	SDC	3	0	0	3	3	50	50	100	ESC
5	B22CI0702	Project – Phase I / Startup	HC	0	0	3	3	6	50	50	100	PROJ
TOTAL				**12**	**0**	**3**	**15**	**18**	**250**	**250**	**500**	
TOTAL SEMESTER CREDITS				**15**								
TOTAL CUMULATIVE CREDITS				**154**								
TOTAL CONTACT HOURS				**18**								
TOTAL MARKS				**500**								

VIII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22CI0801	Project – Phase II/Startup	HC	0	0	12	12	12	50	50	100	PROJ
2	B22CI0802	Global Certification / Internship	HC	0	0	2	2	4	50	50	100	PROJ
TOTAL				**0**	**0**	**14**	**14**	**16**	**100**	**100**	**200**	
TOTAL SEMESTER CREDITS				**14**								
TOTAL CUMULATIVE CREDITS				**168**								
TOTAL CONTACT HOURS				**16**								
TOTAL MARKS				**200**								

Professional Electives in CSIT stream

Sem	Code	Course	Code	Course	Code	Course
PE-I/V sem	B22EJS501	Advanced Database systems	B22EJS502	Agile Software Development and DevOps	B22EJS503	Human Computer Interaction
PE-II/ V sem	B22EJS504	UI/UX Design	B22EJS505	Block Chain Technology	B22EJS506	Mobile Application Development
PE-III/ VI sem	B22EAS601	Computer Vision and Applications	B22EJS602	C# and.NET	B22EJS603	Software Testing
PE-IV/ VI sem	B22EAS604	Natural Language Processing in AI	B22EJS605	Deep Learning	B22EJS606	Compiler Design
PE-V/ VII sem	B22EJS701	Multimedia Systems	B22EJS702	Augmented and Virtual Reality	B22EJS703	Full Stack Development

Open Electives Offered to Other schools											
5th SEM /OE-I			**6th SEM /OE-II**			**7th SEM /OE-III**			**7th SEM /OE-IV**		
Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School
B22CIO 501	Introduction to AI	CIT	B22CIO 601/602	Data Mining/ Machine Learning	CIT	B22CIO701	Python for data science	CIT	B22CIO 703	IoT Programming	CIT
B22CIO 502/503	OOPS with C++/Web technology	CIT	B22CIO 603	Neural Networks	CIT	B22CIO702	Deep Learning	CIT	B22CIO 704	Reinforcement Learning	CIT

Course Title	Multivariable Calculus and Linear Algebra				Course Type		FC	
Course Code	B22AS0103	Credits	3		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	0	0	0	Theory	Practical	CIE	SEE
	practice	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	Pos	PSOs
CO-1	Apply Taylor's and Maclaurin's series for finding series expansions of functions and approximating values.	1,2,4	1
CO-2	Identify the curve forms and evaluate the radius of curvature of the given curve.	1,2,4	1
CO-3	luate the limit using L' Hospital rule after identifying an indeterminate form.	1,2,4	1
CO-4	ve the given system of equations by Gauss elimination and Gauss Jordon method for the consistent equations.	1,2,4	1
CO-5	ermine the Eigen values, the corresponding Eigen vectors and diagonalize the given square matrix.	1,2,4	1
CO-6	Apply Rayleigh's Power method to find the largest Eigen value and the corresponding Eigen vector.	1,2,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents
UNIT - 1
Introduction to Vector Differentiation: Introduction, Scalar and vector point functions, velocity, acceleration, Gradient, Divergence, Curl, Laplacian, Solenoidal and Irrotational vectors, Vector identities**.**
Differential Calculus-1: Successive differentiation- nth derivatives of standard functions (no proof) simple problems, Leibnitz Theorem (without proof) and problems, Taylors series and McLaurin's series expansion for function of one variable (only problems), Polar curves- Angle between the radius vector and the tangent, angle between two curves, Pedal equation for polar curves. Applications in computer science.

UNIT - 2
Differential Calculus-2: Derivative of arc length – concept and formulae (without proof), Radius of curvature-Cartesian, parametric, polar and pedal forms (with proof) problems. Indeterminate forms and solution using L'Hospital's rule. Analysis of Randomized algorithms using Differential Calculus. Applications in computer science.
UNIT – 3
LinearAlgebra-1: Basic concepts, Echelon form, normal form of a matrix, Rank of Matrix, Gauss-Jordon method to find inverse of a matrix, consistency of linear system of equations, Gauss elimination and Gauss-Jordon method to solve system of equations. Linear Algebra for statistics. Applications in computer science.
UNIT - 4
Linear Algebra-2: Linear Transformations, orthogonal transformation, Eigen values and Eigen Vectors. Complex matrices, Similarity of Matrices, Diagonalization. Rayleigh power method to determiner largest Eigen value and the corresponding Eigen vector. Analysis of Randomized algorithms using Linear Algebra. Applications in computer science.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINE:

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

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/107/111107108/
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ma07/
3. https://nptel.ac.in/courses/111/106/111106051/
4. https://nptel.ac.in/courses/111/104/111104092/
5. https://nptel.ac.in/courses/111/104/111104085/

SELF-LEARNING EXERCISES:

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

Course Title	Engineering Chemistry				Course Type		FC	
Course Code	B22AS0104	Credits	3		Class		I Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

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

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

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the phenomenon of light and matter interaction to study the materials	1,2,3	1
CO2	Demonstrate the electrochemical processes & illustrate the method of preparation of solar grade silicon.	1,2,3,7	1
CO3	Select different materials in controlling the corrosion & fabrication of printed circuit boards (PCB).	1**,2,3,7**	1
CO4	Illustrate the properties of polymers, nano materials, composite materials and their applications in various fields.	1,2,3	1
CO5	Know the doping in photovoltaic devices & applications of Jablonski energy diagram.	1**,2,3,6**	1
CO6	Use of promising materials for electrochemical energy storage and engineering, and environmental remedies.	1**,2,3,7**	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents
UNIT - 1
Light and Matter Interaction Electro-magnetic spectrum-Applications in Engineering, Interaction of EM radiation with matter, work function of matter, Electrons in matter. Bonding theories: MOT, Band structure of matters HOMO-LUMO. Photochemical and thermal reactions: Laws of photochemistry, quantum yield, high and low quantum yield reactions. Jablonski diagram – photo physical and photochemical processes, photo-sensitization, photo- polymerization and commercial application of photochemistry.
UNIT - 2
Clean Energy Storage and Conversion Devices Introduction to electrochemistry, basic concepts of Batteries and characteristics. Classification: Primary (Dry cell, Li-MnO_2) and Secondary (Pb-acid, Li-ion) batteries. Super capacitors: classification, construction and applications in hybrid **vehicles**. Fuel cells: Alkaline fuel cells, Solid oxide fuel cells and phosphoric acid fuel cell. Photo-conversion devices: Photovoltaic cell and antireflective coating. Production of single crystal semiconductor by Crystal pulling technique (Czochralski technique), difference between single and polycrystalline materials, zone refining process of Si.

UNIT - 3

Concepts of Corrosion

Thermodynamics and Kinetics of electrochemical corrosion – Theory for corrosion, galvanic series, thermodynamics aspects of corrosion reactions, Nernst equation, dry and wet corrosion and the cell formation, potential- pH diagram (Fe and Al), kinetics of corrosion reactions, Butler-Volmer equation, polarization, passivity, immunity.
Types of corrosion – Galvanic corrosion, pitting, crevice corrosion, and intergranular corrosion.

Corrosion measurements – Weight loss method, by tafel extrapolation plots. Corrosion control – Cathodic protection (Sacrificial anode and impressed current methods), Anodic protection. Protective coatings – Metal coatings (hot dip: tinning and galvanizing), spray techniques, role of inhibitors

UNIT – 4

Chemistry of Engineering Materials

Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in poly acetylene and poly aniline. **Liquid crystals:** Introduction classification and applications in electronic display devices. **Nano materials:** Introduction, classification based on dimensionality, quantum confinement. Size dependent properties- surface area, magnetic properties (GMR phenomenon), and thermal properties. Synthesis, Properties and applications of Fullerenes, CNT and Graphene.
Sensors: Physical and chemical sensors, Biosensors for bio electronic applications.

Text Books:

1. Jain and Jain, "Engineering Chemistry", Dhanapat Rai Publications, 16th Edition, 2015.
2. SS Dara and SS Umare," Engineering Chemistry,"S. Chand Publications, 17th Edition, 2014.
3. R.V. Gadag & Nithyananda Shetty, "Engineering chemistry", Ik International Publishing house, 3rd Edition, 2014.

Reference Books:

1. Fontana. M.G., "Corrosion Engineering", Tata McGraw Hill, 3rd Edition, 2005.
2. Charles P. Poole Jr and Frank J. Owens," Introduction to Nanotechnology", Wiley-Interscience, 1st edition, 2003.
3. V.R. Gowrikar, N.N. Vishwanathan and J. Sreedhar," Polymer chemistry", NEW AGE International Pvt Ltd, 2021.

JOURNALS/MAGAZINES:

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

SWAYAM/NPTEL/MOOCs:

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

Course Title	Communication Skills				Course Type		FC	
Course Code	B22AH0103	Credits	1		Class		I Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**28**	**0**	**50%**	**50%**

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 OBJECTIVE (S):

The Course objectives are to

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

COURSE OUTCOMES: (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence, and comprehension an communicate with one or many listeners using appropriate communicativ strategies (Speaking Skills).	10	
CO2	Develop the ability to write cohesively, coherently, and flawlessly avoidin grammatical errors, using a wide vocabulary range, organizing their ideas logically o a topic (Writing skills).	10	
CO3	Make use of reading different genres of texts by adopting various reading strategie (Reading Skills).	10	
CO4	Take part in interviews confidently and develop accurate writing skills.	10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✔	✔				
CO2	✔	✔				
CO3	✔	✔				
CO4	✔	✔				

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents
UNIT – 1 **Functional English:** Language as a Tool of Communication, - Effective Communication-Modes of Communication- Email communication - Giving Instructions.
UNIT – 2 **Interpersonal Skills:** Traits of good Listener types of Listening-- Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends/relatives, - Process descriptions (general/specific).
UNIT - 3 **Multitasking Skills:** Types of Speaking- Paralinguistic Features-Types of paragraphs (cause and effect / compare and contrast / narrative / analytical); Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions, PPT).
UNIT – 4 **Persuasive Skills:** Reading and Interpretation- SQ3R- Making inference from the reading passage; predicting the content of a reading passage, - Different types of Essay Writing, applying for a job; Writing a cover letter with résumé / CV.

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.
4. Ashraf Rizvi, "Effective Technical Communication" McGraw-Hill Education (India) Pvt. LTD., New Delhi, 2018.

Reference Books:

1. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013.
2. 2.Raman, Meenakshi and Sangeeta Sharma. Technical Communication. Oxford University Press, 2015.
3. 3.Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.

Course Title	Programming with C				Course Type		HC	
Course Code	B22CI0104	Credits	3		Class		I Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVEL OF THECOURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

COURSE CONTENT
THEORY

Contents
UNIT-1 **Algorithm**: Definition, Purpose of writing an algorithm, Rules for writing an algorithm, Advantage of writing algorithm and examples. Flowchart: Definition, Notations used to write a flow chart, Advantage and disadvantages of writing the flowchart and examples. Introduction to "C": Introduction to GitHub, Structure of C program with example, C language & its features, C tokens, data types in C, variables, constants, input and output functions

UNIT-2

Operators and Expressions: Unary operator, assignment operator, arithmetic operator, relational operators, logical operators &bitwise operator, conditional operator, increment and decrement operator, special operator.
Conditional Statements: if statement, if-else statement, nested if, switch statement.
Unconditional Statements: break and continue statement, goto statement, return statement
Iterative Statements (loops): while loop, do-while, for loop, differences between while, do-while and for loop.

UNIT-3

Arrays, functions & Strings: one dimensional array, two dimensional array, Linear and binary search and bubble sorting.
Functions: Structure of a function, types of functions, parameter passing mechanisms, Command line arguments.
Strings: string operations with and without using inbuilt string functions.

UNIT-4

Structures & Union: Derived types- structures- declaration, definition and initialization of structures, accessing structures, neste structures, arrays of structures, union, typedef.
Pointers: Introduction to pointers.
File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions,
File Positioning Functions, Error Functions

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES:

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

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNINGEXERCISES

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

Course Title	Elements of Mechanical Engineering				Course Type		HC	
Course Code	B22ME0103	Credits	3		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW

Elements of Mechanical Engineering is a basic course of Mechanical Engineering discipline. It focuses on overall view of mechanical engineering area's like thermal, design and manufacturing streams. The course is designed to understand basic concept like formation of steam and compute the steam properties like specific volume, enthalpy, and internal energy using steam tables. The students are introduced to internal combustion engines, turbines (water, steam and gas) and refrigeration-air conditioning system. The students will be imparted to calculate BP, IP, mechanical efficiency of IC engines. The students are exposed to the machine elements like springs, belt drives and gear drives. Acquainted with different machine tools like lathe, drilling machines and CNC machines. The students will be exposed to joining processes like Soldering, Brazing and Welding and various power transmission systems. Students are introduced to the engineering materials and modern manufacturing Technology like 3D printing technology.

COURSE OBJECTIVES

The objectives of this course are to

1. Develop the basic knowledge on heat & work, steam formation, working principle of boilers, turbines, IC engines and refrigeration - air conditioning systems.
2. Incorporate the concept of different types of machine elements like springs, belt drives & chain drives.
3. Give exposure in the field of engineering materials and manufacturing processes.
4. Incorporate the concepts of modern manufacturing processes like CNC, 3D printing technology and its applications
5. Acquire a basic understanding role of Mechanical Engineering in the industry and society.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Evaluate the properties of steam and performance parameters of IC engines.	1, 2	1,2
CO2	Describe the working principle of boilers, turbines, refrigeration and air conditioning systems	1	1
CO3	Classify the engineering materials and discuss the concept of casting, CNC machine, laser engraving and 3D printing technology.	1	1
CO4	Compare the different kinds of machine tools and select the suitable machine tool for processing the materials and different metal joining process for the different applications	1,2	1,2
CO5	Discuss the application of machine elements and Calculate the speed ratio of belt drives and Gear Drives.	1,2	1,2
CO6	Describe the need of mechatronics approach in industry and application of robots.	1	1

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

Contents
UNIT-1
Introduction to Energy Systems: Concept of heat and work, Steam formation, Types of steam, Steam properties, numerical on steam properties, Introduction to boilers, working of Babcock and Wilcox boiler.
UNIT-2
Prime Movers: Types and working principle of turbines, IC Engines, numerical on IC engines. **Introduction to Refrigeration and Air Conditioning:** Working principle of refrigeration system, working of domestic refrigerator and window air conditioner
UNIT-3
Materials and Manufacturing Processes: Introduction to engineering materials and classifications, casting, Machine Tools- lathe & drilling machine, metal joining process-welding, brazing and soldering, modern manufacturing technology-CNC machines, laser engraving and 3D printing.
UNIT-4
Machine Elements: Types and applications of springs, belt drives, gear drives and chain drives, numerical on belt drives and gear trains. **Introduction to Mechatronics and Robotics:** Need of Mechatronics in industries, measurement system, open and closed loop control system, Robot anatomy, applications of Robotics.

TEXT BOOKS

1. K R Gopala Krishna, Sudheer Gopala Krishna and S C Sharma, "Elements of Mechanical Engineering", Subhash Publishers, 13th Edition, 2015.

2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, 2000.

REFERENCE BOOKS

1. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, "The Elements of Workshop Technology - Vol I & II", Media Promotors and publisher, 11th edition, 2001.
2. William Bolton, "Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering", Pearson, 2015.
3. K. K. Appukuttan, "Introduction to Mechatronics", Oxford University Press, 2007.

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture

2. International Journal of Refrigeration.

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering
2. https://www.my-mooc.com/en/categorie/mechanical-engineering
3. https://nptel.ac.in/cours

Course Title	IoT and Applications				Course Type		HC Integrated	
Course Code	B22EN0101	Credits	2		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-				
	Practical	1	2	2	Theory	Practical	CIE	SEE
	Total	**2**	**3**	**3**	**14**	**28**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the architecture of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interface of various sensors to IoT Boards.
4. Discuss the various applications of IoT.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Describe the component of IoT architecture	1,2,3,4,5	1,2
CO2	Interpret various Applications of IoT	1,2,3,4,5	1,2
CO3	Identify IoT development boards, sensors & actuator	1,2,3,4,5	1,2
CO4	Identify communication technologies, protocols, and cloud services	1,2,3,4,5,9,10	1,2
CO5	Demonstrate the interfacing of sensors & actuators to IoT board	1,2,3,4,5,9,10	1,2
CO6	Develop simple IoT projects and modules	1,2,3,4,5,9,10	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Course Content Theory:

Contents
UNIT – 1
IoT Basics Previous technologies before IoT, Introduction to IoT, How IoT works, Components of IoT Infrastructure, Basic elements of general IoT Architecture, Characteristics of IoT, benefits and challenges of IoT, Applications of IoT.
UNIT – 2
IoT Enabling Technologies IoT Development Boards: Arduino, Add-on ESP module, Node MCU, Raspberry Pi; Sensors and Actuators: Temperature Sensor, PIR Sensor, Ultrasonic senor; Communication Technologies: Bluetooth, ZigBee, LoRa, WiFi, Cellular; Protocols: HTTP, MQTT, CoAP; IoT Cloud Platforms: Arduino Cloud, Thing Speak, Blink Cloud

PRACTICE:

<table>
<tr><th>Sl. No.</th><th>Title of the Experiment</th><th>Tools and Techniques</th><th>Expected Skill /Ability</th></tr>
<tr><td colspan="4">Part-A</td></tr>
<tr><td></td><td>Introduction to Arduino Board & getting stared with Arduino IDE software</td><td>Hardware & software</td><td>Identifications of various parts of Arduino</td></tr>
<tr><td>1</td><td>Write a program to blink an LED
a) Infinite number of times with ON & OFF duration of 1 sec
b) infinite number of times with ON time duration 2 sec and OFF time duration 0.5 sec
c) Only 3 times with ON and OFF duration 2 sec</td><td>Arduino UNO, Arduino IDE, LED’s</td><td>Arduino coding</td></tr>
<tr><td>2</td><td>Write a program to blink 4 LED in the given pattern
<table>
<tr><th colspan="4">Pattern</th></tr>
<tr><th>L1</th><th>L2</th><th>L3</th><th>L4</th></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table>
<table>
<tr><th colspan="4">Pattern</th></tr>
<tr><th>L0</th><th>L1</th><th>L2</th><th>L3</th></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table>
</td><td>Arduino UNO, Arduino IDE, LED’s</td><td>Arduino coding, Looping structure</td></tr>
<tr><td>3</td><td>Write a program to blink an LED with different times and duration using the concept of user defined function</td><td>Arduino UNO, Arduino IDE, LED’s</td><td>Arduino coding, user define function</td></tr>
<tr><td>4</td><td>Write a program to interface motion sensor and display its status using g LED. If motion is detected it turn on LED otherwise keeps the turn off the LED.</td><td>Arduino UNO, Arduino IDE, LED,
PIR sensor</td><td>Interface PIR sensor</td></tr>
<tr><td>5</td><td>a) Write a program to increase and decrease the brightness of LED.
b) Write a program to control the brightness of LED using Potentiometer</td><td>Arduino UNO, Arduino IDE, LED, Potentiometer</td><td></td></tr>
<tr><td>6</td><td>a) Write a program to interface LDR to Arduino board and display the voltage across LDR on serial monitor
b) Write a program to control the brightness of LED based on the intensity of light on LDR</td><td>Arduino UNO, Arduino IDE, LED, LDR</td><td>Interface LDR sensor</td></tr>
<tr><td>7</td><td>a) Write a program to interface temperature sensor and display the values on the serial monitor
b) Write a program display range of temperature on LCD</td><td>Arduino UNO, Arduino IDE, LCD, Temperature sensor</td><td>Interface Temperature sensor</td></tr>
<tr><td>8</td><td>Write a program to interface ultrasonic sensor and display the distance from an object.</td><td>Arduino UNO, Arduino IDE, Ultrasonic sensor</td><td>Interface Ultrasonic sensor</td></tr>
<tr><td></td><td>Challenging Experiments</td><td></td><td></td></tr>
<tr><td>9</td><td>a) Introduction to ESP module & programming using Arduino IDE software
b) Write a program to demonstrates how to use Wifi module ESP8266-01</td><td>ESP8266 Arduino Uno, LED, Arduino IDE</td><td>Interface of LED to ESP Module, Program ESP</td></tr>
</table>

	to blink LED (with simple LED)		using Arduino IDE
10	Write a program to demonstrate how ESP8266 can be used as an HTTP client and HTTP server to control and monitor the status of an LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server Model
11	Write a program demonstrate how ESP8266 can be used as HTTP Webserver and get commands from the client (mobile/Laptop) directly.	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server model, Create Webserver
12	Write a program to demonstrate how to implement Publisher/Subscriber method (MQTT) to control and monitor the ESP8266 GPIO2 LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Publisher/Subscriber Model
13	Write a program to demonstrate how ESP8266 can be used to log sensor data into thinkspeak cloud.	ESP8266, Arduino Uno, LED, Arduino IDE, ThingSpeak Cloud Service	Connect to cloud and storing data.

Part-B (Case Study/ Projects - Sample Topics)

1. **IoT based Automated Table Lamp**
2. **IoT based Light Dimmer and Speed Controller**
3. **IoT based Energy Monitor and Over Current Cut-off**
4. **IoT based Smart Home Controller Using Blynk**
5. **IoT based Motion Detector Using Cayenne**
6. **IoT based Air Pollution Meter**
7. **IoT based Smart Camera**
8. **IoT based Pet Feeder**
9. **IoT based Electronic Door Opener**
10. **IoT based Underground Cable Fault Detector**
11. **IoT based Air & Sound Pollution Monitoring System**
12. **IoT based Weather Reporting System**
13. **IoT based Toll Booth Manager System**
14. **IoT based Heart Attack Detection & Heart Rate Monitor**
15. **IoT based Person/Wheelchair Fall Detection**
16. **IoT based Water Quality Monitoring System**
17. **IoT based Patient Health Monitoring**
18. **IoT based Garbage Monitoring System**
19. **IoT based Liquid Level Monitoring System**
20. **IoT based Biometric Attendance System**
21. **IoT based Irrigation Monitoring & Controller System**
22. **IoT based Gas Pipe Leakage Detector**
23. **IoT based Alcohol & Health Monitoring System**
24. **IoT based Streetlight Controller System**
25. **IoT based Traffic Signal Monitoring & Controller System**
26. **IoT based Fire Department Alerting System**
27. **IoT based Antenna Positioning System**
28. **IoT based Garbage Monitoring with Weight Sensing**
29. **IoT based Colour Based Product Sorting Machine**
30. **IoT based Smart Mirror with News & Temperature**
31. **IoT based Car Parking System**
32. **IoT based Automatic Vehicle Accident Detection and Rescue System**

TEXTBOOKS:

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

REFERENCE BOOKS:

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

SWAYAM/NPTEL/MOOCs:

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

Course Title	Design Thinking				Course Type		HC Integrated	
Course Code	B22ME0102	Credits	2		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-				
	Practical	1	2	2	Theory	Practical	CIE	SEE
	Total	**2**	**3**	**3**	**14**	**28**	**50%**	**50%**

COURSE OVERVIEW

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world.

In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

COURSE OBJECTIVES

The objectives of this course are to:

1. Impart knowledge on design thinking process for understanding designs.
2. Provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. Inculcate attitude to solve societal problems using design thinking tools.

COURSE OUTCOMES (CO'S)

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

CO	Course Outcomes	POs	PSOs
CO1	Identify the problems that fall under the purview of human centered design process for creative problem solving.	1,2, 9,10,12	2
CO2	Develop empathy maps to visualize user needs and to get insights of the problem.	1,2,9,10,12	2
CO3	Define the problem from user's perception.	1, 9,10,12	1,2
CO4	Apply Ideation techniques to ideate innovative ideas for the problem	1,2,9,10,12	1,2
CO5	Develop simple prototypes for problems using feasible idea.	1,3, 5,9,10,12	1, 2
CO6	Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.	1,8,9,10,12	1,2

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents

UNIT – 1

Design Thinking Process:

Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc., identifying the target users for the problem selected, Survey on existing solutions for the problem identified.

Empathizing: Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies

UNIT – 2

Defining the problems:

POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc.

What is a prototype? - Prototyping as a mind-set, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype

Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

Tutorials:

Sl. No	Name of the Topic	Tools and Techniques	Expected Skill /Ability
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human centered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions

Sl. No	Name of the Topic	Tools and Techniques	Expected Skill /Ability
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop making problem statements from user perception
6	Presentation by student teams	PPT	Develop ability to express their views
7	Carry out Brain storming between the groups and generate as many as ideas possible	Ideation tools	Develop innovative mind set
8	Prototype for best 3 ideas selected	Sketching, simple model making etc.	Develop prototyping techniques
9	Presentation by student teams	PPT	Develop ability to express their plan
10	Test the developed prototype with set of identified users	Google forms , cold calls, social media etc.	Develop understanding of various testing methods
11	Pitching final solution	PPT	Develop ability to express their views

TEXT BOOKS

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

REFERENCE BOOKS

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

JOURNALS/MAGAZINES/ADDITIONAL SOURCES

1. Leonard, D., and Rayport, J. F. 1997. Spark Innovation through Empathic Design. In Harvard Business Review, November-December 1997, 102-113.

2. https://www.ideo.com

3. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

4. https://www.ibm.com/design/thinking/page/toolkit

5.https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we

6. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking

7. https://youtu.be/M66ZU2PCIcM

8. https://thisisdesignthinking.net/2017/07/innogy_energy_ecarsharing/

SWAYAM/NPTEL/MOOCs:

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

2. https://nptel.ac.in/courses/11010612

Course Title	Engineering Chemistry Lab				Course Type		FC	
Course Code	B22AS0105	Credits	1		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practice	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

Engineering chemistry LAB covers very relevant experiment which is related to the topics compatible with ECE students and make them aware of importance of various aspects of basic science in engineering. The practice gives insights on areas of light and matter interaction, optical properties of materials, clean energy, electrical conduction in solutions, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the importance of science which very essential for research in engineering stream.

COURSE OBJECTIVE (S):

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

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

1. It provide the basic knowledge and experimental skill on Interaction of light and matter to know the electronic transitions in materials and storage and conversion devices.
2. Corrosion and metal finishing, explains the phenomenon of corrosion and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB.
3. Electrochemical methods will be used to fabricate materials as thin films and various sensing techniques for lab analysis
4. Preparation of semiconducting and conducting materials, polymers and understand their Commercial significance.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	Pos	PSOs
CO1	Estimate the amount of metal ions present by interaction of light source.	1,2,3,9,10	1
CO2	Demonstrate the electrolytic process in electrochemical cell for the purpose of energy storage and energy conversion devices.	1,2,3,9,10	1
CO3	Describe the corrosion phenomenon and list out various precautions to be taken in the selection of materials in controlling corrosion.	1,2,3,9,10	1
CO4	Preparation of commercially important polymers, Nano materials, composite materials and their applications	1,2,3,9,10	1
CO5	Analyse various water quality parameters in daily life suitable for portability.	1,2,3,8	1
CO6	Preparation of thin film and bulk solid state conductors and semiconductors relevant to device applications	1,2,3,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Practice

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Verification of Beer-Lambert's Law by detection of Copper by spectroscopy.	Calorimeter, Visible spectroscopy, cuvettes	Understand the theory of interaction of light with matter and the electronic transitions in material .Experimentally verify the Beer Lambert law and quantify the amount of substance
2	Estimation of Iron by Potentiometric sensor.	Potentiometer, electrodes, reference electrodes	Understand the theory of potential changes and measure and interpret the potential changes associated with change in chemical composition. This is relevant in electrochemical energy storage and conversion devices like batteries, capacitors, fuel cells
3	Estimation of concentration of acid mixture by Conductometric sensor.	Conductometer, conducting electrolytes	Understand the theory, circuit connection and perform the experiment, Interpret the ionic conductivity in the solution

4	Determination of pH/pKa of solutions using glass membrane electrode sensor.	pH meter, glass electrodes, pH sensing electrochemical cell setup	Understand the electrochemical theory, perform the experiment to sense and evaluate the pH of the give solution. Interpret the importance of pH in engineering materials and their application
5	Faraday's law verification by using Electrodeposition of Cu/Ni/Zn on stainless steel.	DC power supply units, Electrochemical cells, different coating substrate	Understand the theory of soft electrochemical deposition of thin films and perform the experiment on deposition different conductive substrates
6	Determination of percentage of iron in corrosion products.	Ostwald Viscometer	Understand the theory of viscosity and perform the experiment to estimate viscosity of different fluids.
7	Estimation of percentage of Copper in brass alloy by iodometric method	Cu-Zn containing alloy, Iodometric technique	Understand the theory and perform the experiment, collect the data and interpret amount of copper present in the given engineering material
8	Evaluation of Dissolved Oxygen by Winkler's method and hence assessment of quality of water.	Indicators, Industrial and domestic effluents	Understand the theory of Winkler's method and the iodometric estimation.
9	Estimation Of Total Hardness Of Water By Complexometric Method Using EDTA	Hard water, Complexing agents	Understand the theory and perform the experiment to understand and interpret water quality. Devise the easy method for removing the hardness causing agent through complexometry
10	Preparation of semiconducting nanomaterials and characterization.	UV-Vis Spectrophotometer	Understand the theory and perform the experiment to estimate the alkalinity of the industry feed water. Understand the need neutral water, adverse effects of alkaline water
11	Determination of band gap of bulk and Semiconducting materials by UV-Visible spectroscopy.	UV-Visible Spectrophotometer	A better understanding the optical band gap of the materials. Able to perform experiment with UV-Vis spectrophotometer and interpret the spectra and relate with the electronic band structure
12	Synthesis of Conducting Polyaniline from aniline by Chemical method.	Simple oxidation method.	A better understanding of conducting polymers and their relevant applications in devices
13	Preparation of Conducting polyaniline thin film by electro polymerization.	C power supply units, electrochemical reduction techniques, different conducting substrate	To demonstrate the soft and simple electrochemical method for preparation of thin conductive films on desired substrates
14	Preparation of Dye – sensitized solar cell.	FTO, Dyes, Electrolytes, I-V measurement unit, Solar simulation setup	To demonstrate the fabrication of lab scale DSSC and understand the function of photoelectrochemical cell

PART_B: Projects

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Investigation of ionically conducting media	Conductometer, different ionic conductance media	To demonstrate the effect of ionic conductance and understand the importance in electrochemical energy devices
2	pH and Potentiometric sensor	pH meter, Potentiometer	To demonstrate the effect of pH on engineering materials and the potential changes with change in chemical composition
3	Assembly of energy storage devices	Batteries, DC power supply units	To assemble and perform cell voltage and discharge experiments

Text Books

1. V R Gowariker, N V Viswanathan, Jayadev Sreedhar," Polymer Science", Wiley eastern ltd, 4th Edition, 2021.
2. Sudha Rani, S.K. Bashin, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company; 3rd edition, 2012.

Reference Books:

1. J. Mendham, Vogel's "Quantitative Chemical Analysis", 6th Edition, 2009.

Course Title	Programming with C Lab				Course Type		HC	
Course Code	B22CI0108	Credits	1		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	1	2	2	-	28	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a C program using switch statement to design a basic calculator that performs the basic operations such as addition, subtraction, multiplication and division.	Condition statement	Apply switch and if-else
2	People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a C program to find the coefficients of a quadratic equation and compute its roots.	Conditional branching statement	If or if-else or else-if ladder
3	Consider the age of 3 persons in a family, Write a C program to identify the eldest person among three of them.	Condition checking	Apply if-else
4	Consider student's marks in Computer based Test. Write a C Program to display the grade obtained by a student in Computer Test based on range of marks.	Condition checking	Apply if-else, switch
5	In a stock market at the end of the day, summation of all the transactions is done. Write a C program using arrays to a) Display transactions IDs from1 to 'n'.	Looping, sum	Apply for loop and arrays

	b) Find the sum of 'n' natural numbers		
6	In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a C program using 2-dimensional array to check for compatibility of two matrices and perform matrix Multiplication.	Condition checking, matrix operations	Apply if-else, looping and 2-D array
7	Implement a Program to read N integer numbers into a single dimensional array, sort them in ascending order using bubble sort technique and print both the given array and the sorted array with suitable headings.	Sorting	Use 1-D array, looping
8	Suppose students have registered for workshop, and their record is maintained in ascending order based on student ID's. Write a C program to find whether a particular Student has registered for that particular workshop or not using binary search.	Searching	Use 1-D array, looping
9	In a memory game, you first enter a first string and again enter second string, Write a C program to check whether both the strings are same or not.	Comparison, condition	Use string, if
10	Write a C program to define a structure named Student with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth.	Nested structure	Use structure to store the data

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course Title	**Engineering Workshop**				Course Type		**HC**	
Course Code	B22ME0104	Credits	1		Class		I Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	**1**	**2**	**2**				
	Total	1	2	2	0	28	50 %	50 %

COURSE OVERVIEW

Workshop practice provides the basic working knowledge of the production and properties of different materials used in the industry. It also explains the use of different tools, equipment's, machinery and techniques of manufacturing, which ultimately facilitate shaping of these materials into various usable forms. Also to provide the basic knowledge on working and function of two wheeler and four wheeler vehicle engine and power transmission system.

COURSE OBJECTIVES

1. To make student familiar with automobile engine terminology and to have visualization of shape, size and working of engine parts.
2. To introduce the use of tools and instrument and their selection for carrying out the fitting, sheet metal work and welding work.
2. To introduce the processes used of convert of raw material in to product.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Visualise the parts of two wheeler engine and analyse the sequence of parts connected and their functional relationship.	1, 2, 9	1
CO2	Identify and explain the function of the major components of engine and power transmission system of Toyota Innova and Toyota Fortuner cars	1,2,9	1,2
CO3	Prepare the fitting model as per the given engineering drawing by using appropriate fitting tools.	1, 2, 9	1
CO4	Develop the simple sheet metal models as per drawing specification using sheet metal tools.	1,2,3,9	1,2
CO5	Demonstrate the working and application of laser engraving, 3D printing and welding processes.	1, 9	1,2
CO6	Draw the layout of workshop and prepare a technical document about the process to be followed in engineering workshop.	1,10	1

COURSE ARICULATION MATRIX

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

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

Part-A

1. Dismantling and assembly of 2-wheeler (2–stroke) engine Parts.
2. Identification of parts of an engine of Toyota Innova and Toyota Fortuner
3. Calculation of speed ratio of belt, chain and gear drives.
4. Study of power train of bicycle, 2-wheeler and 4-wheeler.
5. Demonstration of laser engraving process and 3D printing process.

Part-B

1. Study of fitting tools and preparation of fitting models.
2. Study of sheet metal tools and development of pen stand and funnel
3. Hands on training on welding.
4. Study of power tools.

TEXT BOOKS

1. K.R. Gopalkrishna, “Elements of Mechanical Engineering”, Subhash Publishers, 12th Edition, 2012.
2. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, “The Elements of Workshop Technology - Vol I & II”, Media Promotors and publisher, 11th Edition, 2001.

REFERENCE BOOKS

1. David A. Crolla, “Automotive Engineering-Powertrain, Chassis System and Vehicle Body”, Butterworth-Heinemann is an imprint of Elsevier, 1st Edition, 2009.
2. R.S.Parmar, “Welding Processes and Technology”, Khanna Publishers, New Delhi, 2003.

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture
2. https://www.shutterstock.com/search/disassembled-bike-engine
3. https://pdfcoffee.com/ex5-assembly-and-disassembly-of-ic-engine-parts-pdf-free.html

SWAYAM/NPTEL/MOOCs

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering
2. https://www.my-mooc.com/en/categorie/mechanical-engineering
3. https://nptel.ac.in/course

II Semester (Physics Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/ MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B22AS0203	Probability & Statistics	FC	3	0	0	3	3	50	50	100	BSC
2	B22AS0106	Physics for Computer Science	FC	3	0	0	3	3	50	50	100	BSC
3	B22EN0102	Introduction to Accounting	FC	1	0	0	1	1	25	25	50	HSMC
4	B22CS0104	Introduction to Data Science	HC	2	0	0	2	2	50	50	100	ESC
5	B22EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	0	3	3	50	50	100	ESC
6	B22ED0101	Elements of Civil Engineering and Engineering Mechanics	HC	3	0	0	3	3	50	50	100	ESC
7	B22ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4	50	50	100	ESC
8	B22AS0109	Physics for Computer Science Lab	HC	0	0	1	1	2	25	25	50	BSC
9	B22CS0108	Data Science Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22EE0102	Basics of Electrical and Electronics Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22CI0201	Skill Development Course-1	SDC	0	0	2	2	4	50	50	100	SDC
12	B22AS0207	Tree Plantation in Tropical Region: Benefits and Strategic Planning	FC	1	0	0	1	1	25	25	50	HSMC
TOTAL				**18**	**0**	**6**	**24**	**30**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS				**24**								
TOTAL CUMULATIVE CREDITS				**44**								
TOTAL CONTACT HOURS				**30**								
TOTAL MARKS				**950**								

Title	Probability and Statistics				Course Type		FC	
Course Code	B22AS0203	Credits	3		Class		II semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO-1	Solve the problems of Curve fitting and regression in various problems in Computer Science and Engineering fields.	1,2,4	1
CO-2	Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.	1,2,4	1
CO-3	Develop a stochastic problem as Markov model as a problem solving methods for systematic model buildings.	1,2,4	1
CO-4	Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.	2,3,4	1
CO-5	Use Discrete time Markov chain to model computer systems.	1,2,4	1
CO-6	Analyse queuing models using queuing theory.	1,2,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

Contents
UNIT – 1 **Curve Fitting**:Curve fitting by the method of least squares and fitting of the curves of the form, *y = ax + b, y = ax2 + bx + c, y = aebx and y = axb* **Statistical Methods**: Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression, problems. Rank correlation. Applications in computer science
UNIT – 2 **Probability distributions:** Recap of probability theory (definition, addition rule, multiplication rule, conditional probability). Random variables, Discrete and continuous probability distributions. Binomial, Poisson, exponential and normal distributions (derivation of mean and variance for all distributions). Applications in computer science.
UNIT – 3 **Joint Probability distribution** : Joint Probability distribution for two discrete random variables (both discrete and continuous cases), expectation, covariance, correlation coefficient. Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. Applications in computer science.

UNIT – 4

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNING EXERCISES:

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

Course Title	Physics for Computer Science				Course Type		FC	
Course Code	B22AS0106	Credits	3		Class		II semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	**3**	**3**	**3**	**42**	**28**	**50%**	**50%**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Impart the knowledge about wave mechanics, electromagnetic waves, and its applications.
2. Demonstrate the different applications of lasers, and optical fibers.
3. Discuss different types of display technologies, touch screen techniques and its applications.
4. Explain the importance of quantum computation as an emerging technology.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply knowledge of wave mechanics, its importance, and applications.	1,2,3	1
CO2	Understand the wave function and applications of Schrödinger wave equation for energy Eigen values of a free particle.	1,2,3	1
CO3	Understand the light-matter interaction and requirement for lasing action.	1,2,3	1
CO4	Classify EM waves based on the frequency range, optical fibers and derive expression for NA, number of Modes and attenuation.	1,2,3	1
CO5	Summarize capacitive and resistive display technologies.	1,2,3	1
CO6	Analyze the working and application of quantum computation	1,2,3	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

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

Electromagnetic Waves: Basic idea of displacement current, Electromagnetic waves, their characteristics, Electromagnetic spectrum (7 types of EM waves) including elementary facts. Uses of EM waves in communications.
UNIT – 3
Optical fibers: Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of core and cladding refractive indices, Condition for wave propagation in optical fiber, V-number and Modes of propagation, Types of optical fibers, Attenuation and reasons for attenuation, Applications: Explanation of optical fiber communication using block diagram, Optical source (LED) and detector (Photodiode) and their applications. Advantages and limitations of optical communications.
UNIT – 4
Display technology: Touch screen technologies: Resistive and capacitive touch screen and Displays: CRT, Field emission display, Plasma display, LED display, OLED display, LCD display. **Quantum Computation**: Quantum wires (one dimensional), Quantum dots (zero dimensional); the idea of "qubit" and examples of single qubit logic gates- Classical bits, Qubit as a two-level system.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINE:

1. https://www.codemag.com/Magazine/ByCategory/Python
2. http://ijaerd.com/papers/special_papers/IT032.pdf
3. https://iopscience.iop.org/article/10.1088/176596/423/1/012027https://ieeexplore.ieee.org/document/4160250
4. Python for scientific computing

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

Introduction to optics, nano devices, quantum tunneling, semiconductor energy gap. characteristics of materials used in manufacture of laptops/desktops (display, internal circuit connection), laser printer working.

Course Title	Introduction to Accounting				Course Type		FC	
Course Code	B22EN0102	Credits	1		Class		II semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	**1**	**1**	**1**	**14**	**-**	**50%**	**50%**

COURSE OVERVIEW

The course introduces the basic framework of accounting to all students to understand accounting concepts and constraints, and help them in preparation of financial records, statements and analysis of the major financial statements.

COURSE OBJECTIVES:

This course enables graduating students to

1. Educate students about the accounting principles and practices.
2. Orient about accounting recording and identification of income, expenses, Assets and Liabilities.
3. Get detailed knowledge of the practice of accounting in different forms of business
4. Gain the ability of using accounting information as a tool in applying solutions for managerial problems, evaluating the financial performance, and interpreting the financial structure.
5. Make students to Apply quantitative skills to analyse and solve business problems and to take advantage of business opportunities.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Acquire conceptual knowledge of basics of accounting and Identify events that need to be recorded in the accounting records	1,2,4,11	1
CO2	Identify and analyse the reasons for the difference between cash book and pass book balances	1,2,4,11	1
CO3	Equip with the knowledge of accounting process and preparation of final accounts	1,2,4,11	1
C04	Develop the ability to use accounting information to solve a variety of business problems	1,2,4,11	1
C05	Describe, explain, and integrate fundamental concepts underlying accounting and finance management	1,2,4,11	1
C06	Explain the need for the bank reconciliation statement and cash balance.	1,2,4,11	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

Contents
UNIT – 1 **INTRODUCTION TO ACCOUNTING & ACCOUNTING PROCESS** Introduction – Meaning and Definition-Objectives of Accounting – Functions of Accounting – Users of Accounting information- Limitations of Accounting – Accounting Principles –Accounting Concepts and Conventions. Meaning – Process of Accounting – Kinds of Accounts – Rules – Transaction Analysis – Journal – Ledger – Balancing of Accounts – Trail Balance Problems, Accounting Concepts: Entity, Money Measurement, Going Concern, Accounting Period, Cost Concept, Dual Aspect, Accounting Mechanism – Single Entry and Double Entry. (Only Theory)
UNIT – 2 **RECORDING OF BUSINESS TRANSACTIONS** - Voucher and Transactions: Origin of Transactions – Source documents and Vouchers, Preparation of vouchers; Accounting equation approach – Meaning and Analysis of transactions using accounting equation; Rules of debit and credit- Capital & Revenue Transactions. The Accounting Process Recording of Transactions: Books of original entry – Journal (Simple problems), types of subsidiary books (i) Cash book – Simple, Cashbook with bank column and Petty cashbook, (ii) Purchases book, Sales book, Purchases returns book, Sale returns book; Ledger: Meaning, Utility, Format; Posting from journal and subsidiary books; Trial Balance- P& L Account and Balance sheet -Bank Reconciliation Statement: Meaning, Need and Preparation, Correct cash balance. (Simple problems)

Reference Books:

1. Tulsian, P.C. “Financial Accounting”, 20th Edition, Pearson Education, 2016
2. S.N. Maheshwari, and. S. K. Maheshwari. “Financial Accounting”. 5th Edition, Vikas Publishing House, New Delhi, 2012.
3. Dr. Jawaharlal, “ Accounting theory and practices”, 4th Edition, HPH, 2022.
4. Bhushan Kumar Goyal and HN Tiwari,” Financial Accounting”, International Book House, 2021

Course Title	Introduction to Data Science				Course Type		HC	
Course Code	B22CS0104	Credits	2		Class		II Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	**2**	**2**	**2**	**28**	**-**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real-world applications.	1 to 4, 12	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5, 12	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1,2,3
CO4	Create the real-world AI based solutions using different machine learning algorithms	1 to 6, 12	1,2,3
CO5	Find modelling Error in Linear Regression	1 to 5	1,2,3
CO6	Use statistical principles to solve mean and standard deviations for given data	1 to 4, 12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Course Content Theory:

Contents

UNIT – 1

Introduction to Microsoft Excel:

History and importance of Microsoft Excel, Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Sorting, Filtering, Grouping, Ungrouping and Subtotal. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel. Import XML Data into Excel, How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.

UNIT – 2

Introduction to Data Science:

What is Data Science? Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents.

Introduction to SQL:

SQL: Basics of Structured Query Language, creation, insertion, updation, deletion, retrieval of tables by experimental demonstrations. Import SQL Database Data into Excel.

UNIT – 3

Data science components:

Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Description of linear regression and Logistic Regression. Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.

UNIT – 4

Data visualization using scatter plots, charts, graphs, histograms and maps:

Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data.

Application of Data Science

Data science life cycle, Applications of data science with demonstration of experiments by using Microsoft Excel.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES:

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

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNING EXERCISES:

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

Course Title	**Basic Electrical & Electronics Engineering**				Course Type		HC	
Course Code	B22EE0101	Credits	3		Class		II Semester	
	LTP	Credits	Contact	Work	Total Number of Classes		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	**Practical**	CIE	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW

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

COURSE OBJECTIVES

The objectives of this course are to:

1) Explain and to make the students familiar about the basics of Electrical Circuits.
2) Illustrate the basics of magnetic circuits and construction, working principle of DC machines, Transformers.
3) Illustrate the characteristics of Diodes and their applications.
4) Discuss the characteristics and applications of BJT's.
5) To familiarize the students about Number systems.
6) To validate the logical expressions using Boolean algebra.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO-1	Summarize the basics of electrical engineering terminology and the usage.	1-2	1
CO-2	Apply KCL and KVL to Solve Electrical Circuits		
CO-3	Demonstrate the working principle of DC Machines and Transformers and provide applications of DC Machines, Transformers.	1-2,4	1
CO-4	Analyze the characteristics of PN junction diode, Zener diode and their application	1-2,4	1
CO-5	Analyze the working principle and characteristics in three configurations of BJT	1-2	1
CO-6	Apply the concept of Number system and Arithmetic operations in digital system	1-2	1

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

Contents
UNIT – 1 **Introduction to Electrical Engineering**: Basics of DC Circuits: Ohms law, Kirchhoff's Current Law, Kirchhoff's Voltage law, Numerical examples as applicable. Basics of AC Circuits: Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation, RL, RC and RLC series and parallel circuits, power factor, phasor diagrams, three phase AC –types of three phase connection (star and delta), Comparison between single phase and three phase AC, Numerical examples as applicable.
UNIT – 2 **Magnetic Circuits and Electrical Machines**: Magnetic Circuits: Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance. Electrical machines: DC Generator, DC Motors, Transformers - Principle of operation, Construction and EMF equations, types and applications. Induction motor: Concept of RMF, Working principle, types and applications Numerical examples as applicable
Unit-3 **Semiconductor Diodes and Transistors**: Semiconductor Diodes :P-N junction diode, V-I Characteristics, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators, Clipping and clamping circuit, Numerical examples as applicable. Transistors: Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.
Unit-4 **Digital Electronics and Number System:** Introduction, Switching and Logic Levels, Digital Waveform. Number Systems and its conversions: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem. Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions.

TEXT BOOKS

1. Nagrath I.J. and D. P. Kothari, "Basic Electrical and Electronics Engineering", Second Edition Tata McGraw Hill, 2020.
2. Hayt and Kimberly, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., "Basic Electrical Engineering", Second Edition, Tata McGraw Hill, 2019.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
5. D.P. Kothari, I. J. Nagrath, "Basic Electronics", Second Edition, McGraw Hill Education (India) Private Limited, 2017.

REFERENCE BOOKS

1. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.
2. Robert L. Boylestad and Louis Nashelsky, "Introduction to Electricity, Electronics and Electromagnetics" Prentice Hall, 5th edition, 2001

SWAYAM/NPTEL/MOOCS

1. https://nptel.ac.in/courses/108108076
2. **https://nptel.ac.in/courses/108101091**
3. **https://www.udemy.com/course/basic-electrical-engineering-part-1**

Course Title	Elements of Civil Engineering and Engineering Mechanics				Course Type		HC	
Course Code	B20ED0101	Credits	3		Class		II Semester	
	LTP	Credits	Contact	Work	Total Number of Classes		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	**Practical**	CIE	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW:

This course introduces the students to basic concepts of Engineering Mechanics, which are essential for all Engineers. The course familiarizes students shall be learning about mechanical interaction between bodies. That is, we will learn how different bodies apply forces on one another and how they then balance to keep each other in equilibrium, and forces and types of forces, centroid and moment of inertia Students will learn about basic concept of forces, force systems, beams, trusses, properties of geometric shapes.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. Understand a broad concept of Engineering Mechanics.
2. Enable students to apply fundamentals and basic concepts of rigid body mechanics to solve problems of bodies in rest.
3. Enable the students to apply conditions of static equilibrium to analyze physical system of coplanar forces.
4. Analyze the civil engineering structures namely determinate beams and trusses.
5. Provide an overview of centroid and moment of inertia of plane area
6. Understand the concept of dynamics and fluid mechanics in civil engineering.

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand basics of mechanics related to Particle, Continuum and Rigid body; Forces, Couple & moment of couple.	1,2	2
CO2	Compute the resultant of system of forces in plane and space acting on bodies.	1,2,5	2,4
CO3	Analyze civil engineering structures using static equilibrium conditions.	1,2,3,4,5	2,4
CO4	Compute the reactions developed at the supports of beams and member forces of trusses.	1,2,3,4,5	2,4
CO5	Determine the centroid and moment of inertia of different geometrical shapes.	1,2,3,4,5	2,4
CO6	Solve the engineering problems using dynamic equilibrium condition.	1,2,3,4,5	2,4

BLOOM'S LEVEL OF THE COURSE OUTCOME

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

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3												1		
CO2	3	3			1									3		1
CO3	3	3	1	1	3									3		3
CO4	3	3	2	1	3									3		3
CO5	3	3	2	1	3									3		2
C06	3	3	1	1	3									3		3

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

Contents

Unit-1

Introduction to Civil Engineering: Scope of Civil Engineering. Effect of the infrastructural facilities on socio-economic development of a country.

Introduction to Engineering Mechanics:

Basic idealizations; Force and its characteristics, Force System and its classification, Principle of superposition of forces, Principle of transmissibility of forces, Moment of a force, couple, moment of a couple, characteristics of couple, Equivalent force - couple system (theory only). Analysis of Force Systems: Resolution of forces, Composition of forces - Definition of Resultant, Composition of coplanar -concurrent force system, Parallelogram Law of forces.

Unit-2

Analysis of Force system: Composition of coplanar - non- concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar concurrent and non-concurrent force systems.

Equilibrium of Coplanar Forces

Definition of static equilibrium, Conditions of static equilibrium for different coplanar force systems, Concept of Free Body Diagram and Lami's theorem with problems.

Unit-3

Centroid: Introduction to the concept, Centroid of plane figures, Locating the centroid of rectangle, triangle and semicircle using method of integration, Centroid of composite sections; Numerical problems.

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

Unit-4

Analysis of structures:

Types of beams, loads, support and problems on beams. Plane trusses: Method of joints with numerical.

Introduction to Dynamics:

Introduction to Kinematics and Kinetics, Rectilinear motion: uniform motion, uniformly accelerated motion, motion under gravity, Concept of Dynamic Equilibrium with problems.

Introduction to Fluid Mechanics:

Introduction, method of describing fluid motion, definitions of types of fluid flow, stream line, path line and stream tube.

Text Books:

1. T R Jagadeesh, “Elements of Civil Engineering”, Sapna book house
2. BK Kolhapure, “Elements of Civil Engineering”, Eastern Book Promoters
3. M.N. Shesha Prakash and Ganesh.B. Mogaveer, “Elements of Civil Engineering and Engineering Mechanics”, PHI Learning, 3rd Revised edition.
4. Engineering Mechanics by RS Khurmi, S Chand and Company.
5. Fluid Mechanics by P.N. Modi and R.K. Bansal.

Reference Books:

1. A. Nelson, “Engineering Mechanics-Statics and Dynamics”, Tata Mc-Graw Hill Education Private Ltd, New Delhi, 2009
2. S. S. Bhavikatti, “Elements of Civil Engineering”, New Age International Publisher, New Delhi, 3rd edition 2009.
3. Hydraulics and Fluid Mechanics Including Hydraulics Machines by Dr. P.N. MODI & S.M. SETH (Author), Standard Book House Since 1960.

Course Title	Computer Aided Engineering Drawing				Course Type		HC	
Course Code	B22ME0101	Credits	3		Class		II Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	3	4	4	28	28	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

The objectives of this course are to

1. Introduce the concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient.
2. Enable students to learn about the software tool for preparing engineering drawings
3. Teach the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids.
4. Communicate the concepts/ideas through the language of technical drawing and sketching.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Draw orthographic projection of point, line manually and also by using CAD software.	1,2,5,10	1
CO2	Draw orthographic projection of plane surfaces manually and also by using CAD software.	1,2,5, 10	1
CO3	Draw orthographic projection of simple solids manually and also by using CAD software.	1,2,5, 10	1
CO4	Draw sectional views of prisms, pyramids, cone and cylinder manually and also by using CAD software.	1,2,5, 10	1
CO5	Draw the development of lateral surfaces of the solids manually and also by using CAD software.	1,2, 3,5,10	1
CO6	Create isometric view of the solids manually and also by using CAD software.	1,2,3,5,10	1

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

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

PRACTICE:

Sl.No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analysing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal	Solid Edge Software	analysing and software skill

Sl.No	Practice	Tools and Techniques	Expected Skill /Ability
	lamina inclined to both HP and VP		
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analysing and software skill
6.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
7.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
8.	Draw the projection of cone and cylinder inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
9	Draw the projection of section of solids in simple position	Solid Edge Software	Analysing and Software Skill
10	Develop the lateral surface of prisms and cylinder	Solid Edge Software	Creative and Software Skill
11	Develop the lateral surface of pyramids and cone	Solid Edge Software	Creative and Software Skill
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analysing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analysing and software skill

TEXT BOOKS

1. K S Narayanswamy and Mahesh L, "Engineering Drawing", WILEY Publishers, 1st Edition, 2017.

2. K. R. Gopalakrishna and Dr. M S Reddy, "Engineering Graphics-1", Subhas Publications, 2015.
3. Bhatt N.D., Panchal V.M and Ingle P.R, "Engineering Drawing", Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.

REFERENCE BOOKS

1. Luzadder and Duff, "Fundamental of Engineering Drawing", Printice Hall of India Pvt. Ltd. 11th Edition, 2001.
2. Shah, M.B. and Rana B.C., "Engineering Drawing and Computer Graphics", Pearson Education, 2008.

SWAYAM/NPTEL/MOOCS

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

Course Title	Physics for Computer science Lab				Course Type		FC	
Course Code	B22AS0109	Credits	1		Class		II Semester	
Course Structure	LTP	Credits	Contact Hours	Workload	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50%**

COURSE DESCRIPTION:

Engineering Physics is very important and necessary basic subject for all branches of engineering students. It provides the fundamental knowledge of basic principles of Physics which is required for basic foundation in engineering education irrespective of branch. This course introduces the experimental concepts of Physics and its applications to Computer Science Engineering courses by emphasizing the following concepts: electrical properties, semiconductor physics, dielectrics, and optical properties. This course provides This course provides basic understanding about the working of different electronic components. This course also teaches students to simulate the working of some electronic components.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Demonstrate the principles covered in your study material in physics.
2. Provide familiarity with apparatus and enable them to handle the instruments and apparatus with purpose.
3. Identify the process to study conditions for a given experiments.
4. Develop an attitude of perfection in practical tasks.
5. Simulate the working of different electronic components using mobile or a computer.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Constructing simple circuits and perform experiments to study voltage-current response.	1, 2,3 4	1,2,3
CO2	Determine the band gap of a semiconducting material.	1,2, 3,5	2, 3
CO3	Determine the dielectric constant of the material.	2,3, 4, 8,	1, 2, 3
C04	Analyze the response of the circuit by combining the electrical/electronic components.	2,3, 4,8,	1, 2, 3
CO5	Determine particle size of the powder and wavelength of the LASER.	1 to 5	1, 2, 3
CO6	Simulate the working of electronic circuits	1 to 5, 8 to 10	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

List of Experiments

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	Determine the value of Planck's constant using LEDs.	LED's, voltmeter and power-supply, Planck's constant apparatus set up, patch cards	Circuit construction and mathematical calculations
2	Study the i-v characteristics of a Zener diode.	Zener diode, DC supply, Ammeters and voltmeters	Circuit construction and mathematical calculation, graph plotting
3	Study the i-v characteristics of a "npn" Transistor in common emitter configuration.	Transistor, DC supply, Ammeters and voltmeters.	Circuit construction, Perform, and plotting of data.
4	Study the i-v characteristics of a Photo Diode.	Photo diode, LED light source, DC supply, Ammeters and voltmeters	Circuit construction, Perform, and plotting of data
5.	Determine the electrical resistivity by 4-probe method	4 probe set up, ammeter, voltmeter, heater,	Circuit construction, Perform, and plotting of data
6	Determine the resonance frequency and quality factor of the given LCR connected in a) Series & b) Parallel.	Signal generator, inductor, capacitor, resistor and ameter	Circuit construction, Perform, and plotting of data

7	Determine numerical aperture of the given optical fiber.	Diode laser, digital dc micrometer two OFC (1.5m &2.5m), optical sensor	Circuit construction, Perform, and plotting of data
8	Calculate the particle size by forming diffraction haloes using LASER.	Lycopodium Powders, glass plate, diode laser, screen	Circuit construction, Perform, and plotting of data
9	Determine the dielectric constant by the method of charging and discharging of a capacitor	Capacitor, timer, voltmeter	Circuit construction, Perform, and plotting of data
10	Determine of wavelength of the light emitted by the given LASER using a grating.	Diode laser, grating, screen	Circuit construction, Perform, and plotting of data

Part B: Demo and Simulation.

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Calculate the band gap of the material of the given semiconductor component.	Beaker with hot water, thermometer, component and multimeter	Circuit construction, Perform, and plotting of data
2	Verify Stefan's law of black body radiation.	Incandescent bulb, ammeter and voltmeter	Circuit construction, Perform, and plotting of data
3	Simulate the characteristics of simple electronic components (Resistor, Diode, Zener Diode, Transistor, Tunnel diode, LCR and JFET)	Everycircuit (android app) Tina (Online simulator)	Visualize, simulate and analyse

Text Books

1. M.N. Avadhanulu and P.G. Kshirsagar, "A Text book of Engineering Physics", S. Chand & Company Ltd, New Delhi, 10th revised Ed

2. Gaur and Gupta, "Engineering Physics", Dhanpat Rai Publications 2017

REFERENCE BOOKS:

1. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Edu Pvt Ltd- New Delhi, 6 th Ed 2006

2. S O Pillai, "Solid State Physics", New Age International Publishers, 8th Ed

3. S M Sze, Physics of Semiconductor devices, Wiley, 2004

Course Title	Data Science Lab				Course Type		HC	
Course Code	B22CS0108	Credits	1		Class		II Semester	
Course Structure	LTP	Credits	Contact Hours	Workload	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50**	**50**

COURSE DESCRIPTION:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Microsoft Excel in developing the real-world applications.	1, 2, 4,10	1,2,3
CO2	Apply the SQL Queries in developing the real-world applications.	1,2, 3,9,10	2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using regression algorithms.	2,3, 4, 8,9, 10	1, 2, 3
C04	Design ER diagrams for database.	2,3, 4,8, 9, 10	1, 2, 3
CO5	Illustrate modeling in Multiple Linear Regression.	1 to 5, 8 to 10	1, 2, 3
CO6	Demonstrate the Logistic Regression to predict the Data.	1 to 5, 8 to 10	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

Practice:

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	The height (in cm) of a group of fathers and sons are given below, Findthe lines of regression and estimate the height of son when the height of father is 164 cm. **Hgt of Father**: 158, 166, 163, 165, 167, 170, 167, 172, 177, 181 **Hgt of Son**: 163, 158, 167, 170, 160, 180, 170, 175, 172, 175	MS Excel	Create and perform operations on Excel data set by applying Linear regression
2	Using the data file DISPOSABLE INCOME AND VEHICLE SALES,perform the following: **i)** Plot a scatter diagram. **ii)** Determine the regression equation. **iii)** Plot the regression line (hint: use MS Excel's Add Trend line feature. **iv)** Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900. **v)** Compute the coefficient of determination and the coefficient of correlation	MS Excel	Perform prediction and visualiza-tion of data

<table>
<tr>
<td>3</td>
<td>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.

i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trend line feature).
iv) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
v) Compute the coefficient of determination and the coefficient of correlation.</td>
<td>MS Excel</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>4</td>
<td>Apply multiple linear regression to predict the stock index price which is a dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.
<table>
<tr><th>Year</th><th>Month</th><th>Interest rate</th><th>Un employment rate</th><th>Stock index price</th></tr>
<tr><td>2022</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr>
</table>
</td>
<td>MS Excel</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>5.</td>
<td>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10,00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for availed of Rs.10, 00,000during 3 years.
<table>
<tr><th>Sl.no</th><th>A</th><th>B</th></tr>
<tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr>
<tr><td>2</td><td>Annual interest rate</td><td>5.2%</td></tr>
<tr><td>3</td><td>Year of the loan</td><td>3</td></tr>
<tr><td>4</td><td>Starting payment number</td><td>1</td></tr>
<tr><td>5</td><td>Ending payment number</td><td>36</td></tr>
<tr><td>6</td><td>Total interest paid during period</td><td>?</td></tr>
</table>
</td>
<td>MS Excel</td>
<td>Create Excel data and perform EMI estimator</td>
</tr>
<tr>
<td>6</td>
<td>Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO should not be NULL.</td>
<td>SQL</td>
<td>Creating Tables</td>
</tr>
<tr>
<td>7</td>
<td>Create the customer database of a big Market with CUSTOMER_ ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_ CODE. Store at least twenty customer’s details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.</td>
<td>SQL</td>
<td>Creating and retrieving Tables</td>
</tr>
<tr>
<td>8</td>
<td>Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.</td>
<td>MS Excel</td>
<td>Apply Linear regression</td>
</tr>
<tr>
<td>9</td>
<td>Apply Multiple linear regression to predict the factory products which is A, B and C are independent variables and cost dependent variable.</td>
<td>MS Excel</td>
<td>Apply Linear regression</td>
</tr>
</table>

10	Logistic Regression-case study	MS Excel	Apply Logistic regression
11	Design the ER diagram and create schema of the REVA library Management system.	Entity Relationship	Entity Relationship
12	Design the ER diagram and create schema for Hospital Management system.	Entity Relationship	Schema design

PART_B:Projects

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Big Mart sales forecasting	MS Excel	Apply Linearregression
2	Bangalore crime analysis	MS Excel	Apply Linearregression

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES:

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

Course Title	Basic Electrical & Electronics Lab				Course Type		HC	
Course Code	B22EE0102	Credits	1		Class		II Semester	
Course Structure	LTP	Credits	Contact	Work	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW

Basic Electrical & Electronics Engineering lab covers the concept of various types of electrical apparatus, tools and conduction of experiments to Analyze, Design of KCL & KVL, two-way switch or staircase wiring, Determination of VI characteristics Zener Diode, Silicon Diode, Half Wave rectifier using Diode, study& analyses of Lead & lag component, verification of logic gates.

COURSE OBJECTIVES

The objectives of the course are to

1. Establish 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. Train students to read and understand schematics so as to make electrical connection for different appliances.
4. Train students in collecting and interpreting experimental data.
5. Enhance written skills of students.

COURSE OUTCOMES (CO'S)

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

CO#	Course Outcomes	PO's	PSO's
CO-1	Use appropriate electrical tools for electrical connections and repair of electrical equipment's.	1,2,4,5,9,10	1
CO-2	Recognize various symbols in a schematic and make connection as per the schematic	1,2,9,10	1
CO-3	List out various safety procedures	4,5,9,10	1
CO-4	Make use of various measuring instruments to collect experimental data	2,4,9,10	1
CO-5	Analyse the results obtained from experiments.	2,3,9,10	1
CO-6	Demonstrate the ability to critically evaluate the performance of electrical appliances.	1,2,9,10	1

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

List Experiment

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	To verify KCL and KVL	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2	Study and Analysis of Lead & Lag networks by using R-C components.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
3	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring	Two-way switch or staircase wiring Kit	Connection, Working & application of Two-way switch
4	Study and analysis the Characteristics: light sensor and temperature sensor	Sensor kit	Characteristics of sensors
5	Study and analysis of V-I Characteristics of Zener PN Junction diodes (Both Forward and Reverse Characteristics).	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
6	Study and analysis of Transistor as switch	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor of rectifiers
8	Design of Clippers and clampers with reference voltages	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
9	Study and analysis of input output characteristic of CE configuration of BJT.	Characteristics of BJT in Common Emitter Configuration	Input & Output Characteristics of BJT
10	Verification of basic logic gates using discrete components	Trainer kit	Universal gates will be realized using basic gates

Demo:

1. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.
2. To study the Importance and mechanism of MCB.

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.

REFERENCE BOOKS

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

SWAYAM/NPTEL/MOOCs

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091
3. https://www.udemy.com/course/basic-electrical-engineering-part-1

Course Title	Tree Plantation in Tropical Region: Benefits and Strategic Planning				Course Type		FC	
Course Code	B22AS0208	Credits	1		Class		II Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	1	1	1	14	0	50%	50%

Course Description: This course introduces significance of trees that provide us with a great many ecosystem services, including air quality improvement, energy conservation, stormwater interception, and atmospheric carbon dioxide reduction. These benefits must be weighed against the costs of maintaining trees, including planting, pruning, irrigation, administration, pest control, liability, cleanup, and removal.

Students are expected to involve in planting a tree and nurturing till the completion of their degree program. Successful maintenance of tree is considered to be one of the eligibility criterions for the award of university degree.

This course is a part of "**REVA Vanamahotsava – One Student, One Tree"**

COURSE OBJECTIVE (S):

The Course objectives are to

1. Develop basic understanding of role of trees in climate change
2. Emphasize on the selection and placing a tree for maximum benefit to environment
3. Involve in planting a tree and nurture till the completion of the degree program
4. Generate experiential report on the tree plantation process involved

COURSE OUTCOMES: (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Interpret the possible key benefits of trees arresting climate change and global warming	7,9	
CO2	Develop the ability to identify the type of a tree to be planted in urban area agricultural fields and forestry areas	7,9	
CO3	Make use of reading different literature on climate change and global warming by adopting various reading strategies (Reading Skills)	7,9	
CO4	Take part in planting a tree and nurturing it and Generate report on tree plantatio process involved	7,9	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		✓		✓		
CO2		✓	✓	✓		
CO3		✓		✓		
CO4		✓		✓		✓

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents

Unit 1: Introduction: The tropical region, Benefits and costs of urban and community forests

Unit 2: General Guidelines for Selecting and Placing Trees Guidelines for Energy Savings, Guidelines for Reducing Carbon Dioxide, Guidelines for Reducing Stormwater Runoff, Guidelines for Improving Air Quality Benefits, Guidelines for Avoiding Conflicts with Infrastructure, Guidelines for Maximizing Long-Term Benefits, Trees for Hurricane-Prone Areas

Activity based learning

Every student has to thoroughly understand the significance of planting a tree, identify type of tree and place to be planted, plant a tree and nurture till the completion of the degree.

Text Books:

1. Kelaine E. Vargas, E. Gregory McPherson, James R. Simpson, Paula J. Peper, Shelley L. Gardner, and Qingfu Xiao, "Tropical community tree guide: Benefits, Costs and Strategic Planting", U.S. Department of Agriculture, Forest Service Pacific Southwest Research Station Albany, California, 2008

Reference Books:

1. Peter Wohlleben, The Heartbeat of Trees, Penguin Books, 2021
2. Daniel Chamovitz, "What a Plant Knows: A Field Guide to the Senses", 2020

Evaluation of this course

As per 9.27 of the **"Academic Regulations UG -Engg 2022",** following evaluation procedure is applicable to this course.

9.27 Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below (for theory courses having Credit 1).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8th Week	First 50%	25	12.5	8th week
2	Test -2	During 15th Week	Remaining 50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

Additional guidelines for conducting this course

Since this course is aimed as a special drive to restore climate change and arresting global warming, following guidelines have been framed to conduct this course as activity-based learning to build greener nation through student community. Successful implementation of this drive meets one of the very important Sustainable Development Goals (SDG's) of UN Envision 2030 on Climate Change and Global warming. This is also one of the requirements in NEP 2020 and UGC/AICTE.

1. Classes will be conducted by the nominated faculty (one hour per week) as per the syllabus.
2. Flipped classes, field experiences, group discussions and seminars can be used by the faculty so as to engage the students through student centric learning mechanisms
3. Students should be involved into understanding cause and effects of climate change, types of pollutions, and environmental hazards
4. Quizzes and debates on climate change and global warming can be arranged for each section
5. Students should plant the suitable tree and nurture
6. "Team Vanamahotsava" – A Central assistance team from REVA University will support for identifying trees, place and organizing plantation drives.
7. Regular progress review is planned to be monitored by digital system – an advanced version of current progress monitoring App.
8. School Directors are responsible to oversee all the arrangements and progress monitoring of this drive.
9. Frequent school level and university level branding shall be arranged to give awareness of this noble drive among all the stake holders such as parents, alumni, industry and academic partners, government sectors, NGO's, ministries, and the society.
10. Regular plant maintenance drive can be planned by "Team Vanamahotsava". However, planting a tree and its nurture responsibility solely rests on individual students.
11. Successful maintenance of tree is considered to be one of the eligibility criterions for the award of university degree.

Semester - 3

Course Title	Discrete Mathematics and Graph Theory				Course Type		FC	
Course Code	B23AS0301	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives and quantifiers	1,2,3	2
CO2	Student should learn about predicate logic in mathematical statements. Student should understand the concept of logical inference and be able identify valid and invalid arguments.	1,2,3	2
CO3	To understand and to distinguish different types of relations and functions.	1,2,3	2
CO4	Student should develop the ability to use logical reasoning to prove properties of relations and functions.	1,2,3	2
CO5	Illustrate the concept of isomorphic graphs and isomorphism invariant properties of graphs	1,2,3	2
CO6	Develop a model using advanced concepts of graph for real world applications	1,2,3	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4		√				
CO5		√				
C06			√			

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Mathematical Logic: Propositions, Logical Connectives and truth tables (Illustrative Examples), Logical equivalence, Laws of logic, Duality, NAND and NOR connectives (Circuits), Converse, Inverse and Contrapositive, Rules of Inference, Quantifier, Logical implication involving quantifiers.

Applications: Design of computing machines, artificial intelligence, definition of data structures for programming languages etc.

UNIT – 2

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

Application: Data structures, Class-based object-oriented systems, Machine learning, Databases, Pattern matching, and by extension, compilers

UNIT – 3

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

Applications: Finding shortest routes in car navigation systems, Search engines use ranking algorithms based on graph theory, Analysis of social networks, Compilers use coloring algorithms to assign registers to variables, Path planning in robotics

UNIT – 4

Euler and Hamiltonian graphs and Graph coloring: Definition of Euler Graphs, Hamiltonian Graphs, Standard Theorems on Euler and Hamiltonian graphs, planar graph, Dual of planar graphs, Graph coloring, Chromatic polynomial, Five Color Theorem, Matching, Cut set, Network flow, and its applications.

Applications: Graph coloring especially used various in research areas of science such data mining, image segmentation, clustering, image capturing, networking etc.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

1. https://www.journals.elsevier.com/discrete-mathematics
2. http://www.math.iit.edu/~kaul/Journals.html

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

SWAYAM/NPTEL/MOOCs:

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

Course Title	Universal Human Values				Course Type		Theory	
Course Code	**B22EE0310**	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**2**	**2**	**28**	**0**	**50%**	**50%**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applyingthem in their life and profession.	6,7,8	1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	6,7,8	1
CO3	Understand the role of a human being in ensuring harmony in society andnature.	6,7,8	1
CO4	Demonstrate the role of human being in the abetment of pollution.	6,7,8	1
CO5	Describe appropriate technologies for the safety and security of the society asresponsible human being.	6,7,8	1
CO6	Distinguish between ethical and unethical practices and start working out thestrategy to actualize a harmonious environment wherever they work.	6,7,8	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

Content
Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
Unit - 2
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co- existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit - 3
Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Unit - 4
Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize theprofessional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management modelsand production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

TEXT BOOKS

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010
4. Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

REFERENCE BOOKS

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

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

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

EVALUATION PATTERN:

- Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment
- Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.
- Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	Indian Constitution				Course Type		MC	
Course Code	B22MEM301	Credits	0		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	0	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**0**	**2**	**2**	**28**	**-**	**50**	**50**

COURSE OVERVIEW

The Constitution of India lays down in defining fundamental political principles, establishes the structure, procedures, powers and duties of government institutions and sets out fundamental rights, directive principles and duties of citizen. It helps to know and understand state executive & elections system of India..

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. To know about the basic structure of Indian Constitution.
2. To know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.
3. To know about our Union Government, political structure & codes, procedures.
4. To know the State Executive & Elections system of India.
5. To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Analyze the basic structure of Indian Constitution	6,8,9, 12	1,3
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution	6,8,9, 12	1,3
CO3	Know about Indian Union Government, political structure & codes, procedures.	6,8,9, 12	1,3
CO4	Understand our State Executive & Elections system of India	6,8,9, 12	1,3
CO5	Understand the Amendments and Emergency Provisions, other important provisions given by the constitution	6,8,9, 12	1,3
CO6	Understand constitutional amendments till today	6,8,9, 12	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

Unit – 1
Indian Constitution: Necessity of the constitution, societies before and after the constitution adoption, introduction to the Indian constitution, making of the constitution, role of the constituent assembly.
Unit – 2
Salient features of India Constitution: Preamble of Indian constitution and key concepts of the preamble, fundamental rights and its restriction and limitations in different complex situations.
Unit – 3
DPSP's and Fundamental Duties: Directive Principles of State Policy (DPSP's) and its present relevance in Indian society, fundamental duties and its scope and significance in nation, union executive: parliamentary system, union executive – president, prime minister, union cabinet.
Unit – 4
Executive and Elections system of India: Parliament - LS and RS, parliamentary committees, important parliamentary terminologies, judicial system of India, supreme court of India and other courts, judicial reviews and judicial activism, state Executive and Governer, CM, state cabinet, legislature - VS & VP, election commission, elections and electoral process, amendment to constitution, and important constitutional amendments till today, emergency provisions.

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.

REFERENCES BOOKS:

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

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

Examination Pattern:

The course is Mandatory course, As per the regulations 23-24 no IA tests or assignments for the course evaluation. Semester End Examination question paper is of MCQ pattern set for maximum marks of 50. Marks obtained is scaled down to 25.

Course Title	Technical Documentation				Course Type		FC	
Course Code	**B22EN0308**	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**1**	**1**	**14**	**0**	**25**	**25**

COURSE OVERVIEW:

Technical writing is all about strategically placing facts and figures in a sensible and user-understandable way. A structured approach encourages creating a better output, all the while considering available resources and objectives. This course focusses on various factors to improve the skills of Technical documentation.

COURSE OBJECTIVE (S):

The objectives of this course are:

1. Acquire language skills
2. Develop linguistic and communicative competencies
3. Study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Produce effective engineering documents that enable readers to access relevant information.	6,8,9,10,12	1
CO2	Learn to avoid communication problems that distract the readers, causing confusions, distrust, or misunderstanding.	6,8,9,10,12	1
CO3	Practice various verbal reasoning and grammar practice.	6,8,9,10,12	1
CO4	Search engineering information, both in traditional ways and online.	6,8,9,10,12	1
CO5	Write research/design reports with special emphasis on content and style.	6,8,9,10,12	1
CO6	Improve the art of presentations in team	6,8,9,10,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Contents
UNIT – 1
Information Design and Development- Different kinds of technical documents, Information development life cycle, factors affecting information and document design, Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.
UNIT-2
Advanced Technical Communication : Introduction to advanced technical communication, Usability, Managing technical communication projects, time estimation, Single sourcing, Localization, Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

TEXTBOOKS:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 7.Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).

Evaluation pattern:

Since Technical documentation is 1 credit course and asper the regulations 23-24, IA1 and IA2 will not be conducted however internal assessment marks of 25 will be awarded based on two assignments/quizzes/presentation.

- **Semester End Exam is for 25 Marks and evaluation is based on the Technical report prepared by the students and viva-voce. This exam will be conducted during semester end practical examination slot.**

Course Title	Programming with Python				Course Type		HC	
Course Code	B22CI0301	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

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

UNIT-4

NumPy: Introduction to NumPy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output.

Pandas and Data Visualization: Introduction, Series and Data Frames in pandas and Data Visualization.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNINGEXERCISES:

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

Course Title	Data Structures				Course Type		HC	
Course Code	B22CI0302	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the Abstract Data Types, Structures.	1,3, 5,10,11	1
CO2	Formulate the solution for any computational problem using stacks and queues.	3,8	1,2
CO3	Analyze the importance of linked lists.	5,7,9	1,2
CO4	Solve real time problems using trees data structure.	1,2,7,8,9,10	1,2
CO5	Apply appropriate data structures to solve a given problem.	1 , 5,7,8,9,12	1
CO6	Compare the performance of various data structures.	2,7,8,9,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1
Introduction to Data structures and Algorithms: Data, Data Types, Abstract Data Types and Examples, Algorithms, Arrays: One Dimensional and Two Dimensional, Structures: Introduction to structures and nested structures.
UNIT – 2
Data Structures-1: Stacks, Evaluation of expressions: Infix, Prefix, postfix; Queues: Simple, circular and priority Queues.

UNIT – 3
Data Structures-2: Pointers; Dynamic memory allocation; Linked List: singly linked list, doubly linked list, stack using linked list, queue using linked list.
UNIT – 4
Data Structures-3: Trees: Binary Tree, Binary Tree Traversals, Binary search Tree

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Analog and Digital Electronics				Course Type		HC	
Course Code	B22CI0303	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the applications of diode in wave shaping circuits.
2. Discuss working principle of different types of oscillators.
3. Discuss performance parameters and applications of Operational amplifiers
4. Describe designing, building and testing of common combinational circuits
5. Describe designing, building and testing of common sequential digital logic circuits.
6. Illustrate applications of Ring Counter and Johnson Counter.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in clipping ,clamping wave and working principle of oscillators	1 to 4	1
CO2	Apply the basic knowledge used in operational amplifiers for specific engineering applications.	1 to 3	1
CO3	Identify the different families of digital integrated circuits and working principle of combinational circuits	1 to 2	2
CO4	Develop minimization techniques of combinational circuits using K-map	1 to 4	1
CO5	Analyze the working principle of sequential circuits such as Flip-Flops , Counters and shift registers.	1 to 3	1
CO6	Develop the ability to analyze and design adders, subtractors, multiplexers and demultiplexers.	1 to 4	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

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

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UNIT- 2

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Course Title	Theory of Computation				Course Type		HC	
Course Code	B22CI0304	Credits	4		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks/Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**4**	**4**	**4**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Construct the Finite State Machine by applying the concepts of DFA and NFA.	1 to5,11,12	1
CO2	Make use of regular expressions for constructing DFA and NFA.	1to5,11,12	2
CO3	Identify ambiguity in grammar and Construct CFG for the given language in Normal Forms.	1 to5,11,12	3
CO4	Apply the concepts of Push down Automata and Turing machine for a given Language.	1to5,11,12	2
CO5	Understand the complexity or difficulty level of problems when solved using these machines.	1to5,11,12	2
CO6	Explore the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages.	1 to5,11,12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX:

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

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

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to finite automata: Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata

UNIT-2

Regular Expressions, regular languages, and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;

UNIT-3
Context free Grammars and Normal forms: Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.
UNIT-4
Push Down Automata and Turing Machine: Push down automata (PDA); Languages of a PDA; Deterministic PDA; Turing Machine.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Programming with Python Lab				Course Type		HC	
Course Code	B22CI0305	Credits	1		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	Total	**1**	**2**	**2**	**-**	**28**	**25**	**25**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			
1.	a). "LIST1" is a list that contains "N" different SRN of students read using a user defined function with the help of input () function. It is required to add SRN of "M" more students that are to be appended or inserted into "LIST1" at the appropriate place. The program must return the index of the SRN entered by user.	Windows/Linux OS, IDE, Jupiter	Create and perform operations on list.
	b)"TUPLE1" and "TUPLE2" are two tuples that contain "N" values of different data types read using the user defined function "READ" with the help of input() function. Elements of "TUPLE1" and "TUPLE2" are to be read one at a time and the "larger" value among them should be placed into "TUPLE3". Display all tuples.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on Tuples.

2.	a)SET1 and SET2 are two sets that contain unique integers. SET3 is to be created by taking the union or intersection of SET1 and SET2 using the user defined function Operation (). Perform either union or intersection by reading choice from user. Do not use built in functions union () and intersection () and also the operators "|" and "&".	Windows/Linux OS, IDE, Jupyter	Create and perform Union and Intersection, Operations on Sets.
	b)The Dictionary "DICT1" contains N Elements and each element in dictionary has the operator as the KEY and operand's as VALUES. Perform the operations on operands using operators stored as keys. Display the results of all operations.		Create dictionary and perform operation using user defined function.
3.	a)A substring "Substr" between index1 and index2 is to be extracted from the given input string "Str1", which is read using input(). Display the substring "Substr" using a user defined function if available in string "Str1", otherwise display NULL. b) A string containing multiple words is to be read from the user one at a time, after reading perform following operations. Convert all the strings to uppercase and display Split the words of a string using space as the separation character and display.	Windows/ Linux OS, IDE, Jupyter	String operations.
4.	a)Consider the text file, "Std.txt", with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, "Std.txt" and display the details of all the students of 4th Semester "A" Section who have scored more than 75%.	Windows/ Linux OS, IDE, Jupyter	File Handling.
	b)Consider the text file "Emp.txt", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following: TOTAL_DEDUCTIONS= (LIC+PF) GROSS_SALARY= BASIC_SALARY+ DA NET_SALARY= GROSS_SALARY – TOTAL_DEDUCTIONS. Write the above data to file for each employee. Read the content of "Emp.txt" and display the details of each employee		File Handling.
5.	a). A "CAR" has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACUTING_YEAR and PRICE. A Class is required to be created for "CAR" to store the above attributes and perform the following operations: Get the details of "CAR" object from user and store into Array of objects Display the details of "CAR" object based on "COMPANY", "MODEL" and "PRICE".	Windows/ Linux OS, IDE, Jupyter	Classes and objects usage.

	b). Airline Reservation System contains the attributes of passengers such as NAME, PAN_NO. MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for "Airlilne" with the above attributes and perform the following operations: Get the details of "Airline" object from user and store into Array of objects List details of all the passengers who travelled From "Bengaluru to London". List details of all the passengers who travelled From "Chicago to Beijing" on 10th of Feb, 2020.		
6.	a). "Arr_1" is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the Diagonal elements of"Arr_1" Elements of m^{th} row (row no should be entered by user) Elements of n^{th}column (column no should be entered by user)	Windows/ Linux OS, IDE, Jupyter	NumPy arrays usability.
	b)The dictionary "DICT1" contains the pass percentage of each semester of B. Tech in CSE, where, "Semester" acts as the key and "Pass Percentage" acts as the value. A Python Pandas dataframe is required to be created using the dictionary "DICT1" and display it using a user defined function.		Pandas Series usability.

	Part-B (Mini Project: Library Management System)		
1.	Develop a program to create the class "USER" with the attributes USER_NAME, USER_ID, SCHOOL_NAME, ADDRESS, PHONE_NO, EMAIL_ID, DOB and AGE. The functions add user (), delete user (), edit user (), search user () should be part of the class. Instantiate "User" class with 10 objects. Read the attributes of each "User" object using input () and store them in the file "User_File.txt".	Windows/ Linux OS, IDE, Jupyter	Create a class user to read the attributes of user and store them in a file.
2	Develop a program to get the name of the "User" object whose details are to be deleted. Read the "User_File.txt" and delete the "User" object if found. Display the contents of "User_File.txt" after deletion.	Windows/ Linux OS, IDE, Jupyter	Create a class user to read the attributes and
3	Develop a program to get the name of the "User" object whose details are to be edited (modified). Edit the details of the user object in the file "User_File.txt" and display the contents after modification.	Windows/ Linux OS, IDE, Jupyter	To create a class and edit the file.
4	Develop a program to create the class "BOOK" with the attributes TITLE, AUTHOR, PUBLISHER, YEAR, PRICE, SCHOOL_NAME and the functions add book(), delete book(), edit book() and search book(). Instantiate "Book" class with 10 objects. Read the attributes of each "BOOK" object using input () and store them in the file "Book_File.txt".	Windows/ Linux OS, IDE, Jupyter	Create a class book to read the attributes of user and store them in a file.
5	Develop a program to get the name of the "BOOK" object whose details are to be deleted. Read the "Book_File.txt" and delete the "BOOK" object whose details match with the data entered. Display the contents of "Book_File.txt" after deletion.	Windows/ Linux OS, IDE, Jupyter	Create a class book to read the attributes and delete the object
6	Develop a program to get the name of the "BOOK" object whose details are to be edited (modified). Edit the details of the "Book" object in the file "Book_File.txt" and display the contents after modification.	Windows/ Linux OS, IDE, Jupyter	To create a class and edit the file.
7	Develop a program to create the class "TRANSACTION" with the attributes USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE,DUE_DATE and RETURN_DATE and the functions issue book(), return book() and search book(). Instantiate "Transaction" class with 10 objects. Read the attributes of each "Transaction" object using input () and store them in the file "TransactionFile.txt". Develop a program to issue the book as requested by the user. Update the attributes in "Transaction _File" and display the contents of file.	Windows/ Linux OS, IDE, Jupyter	Create class and perform string operations.
8	Develop a program to return the book. Edit the details of the user like USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE in "TransactionFile.txt" and display the contents after modification. Compute the fine amount to be paid if return date is not same as due date. If both return date and due date are same and put zero in fine amount.	Windows/ Linux OS, IDE, Jupyter	Create class and perform string operation.
9	Develop a program to search for a book using its "author". Display the message "available" if search is successful otherwise display the message "not available".	Windows/ Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular
10	Develop a program to get a list of users by referring to "User_File.txt" and "Transaction_File.txt".	Windows/ Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular
11	Develop a program to get List of Books in stock by referring to "Book_File.txt" and "Transaction_File.txt".	Windows/ Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular

12	Develop a program to get List of Books Issued by referring to “User File”, “Book File” and “Transaction File”.	Windows/ Linux OS, IDE, Jupyter	Create class and object, perform file operations
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/ Linux OS, IDE, Jupyter	Module integration and project development.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course Title	Data Structures Lab				Course Type		HC	
Course Code	B22CI0306	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PRACTICE:

1	Design, Develop and Implement a menu driven Program in C for the following Array operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. Support the program with functions for each of the above operations.
2	Design, Develop and Implement a Program in C for the following operations on Strings a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: c. Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. d. Report suitable messages in case PAT does not exist in STR Support the program with functions

	for each of the above operations. Note: Don't use Built-in functions
3	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^ (Power) and alphanumeric operands.
5	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks 21 6 Design, Develop and Imp
6	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion and Deletion at End of SLL d. Perform Insertion and Deletion at Front of SLL e. Demonstrate how this SLL can be used as STACK and QUEUE f. Exit
8	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue f. Exit
9	Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Delete an element(ELEM) from BST e. Exit

Course Title	Analog and Digital Electronics Lab				Course Type		HC	
Course Code	B22CI0307	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the applications of diode in wave shaping circuits.
2. Discuss working principle of different types of oscillators.
3. Discuss performance parameters and applications of Operational amplifiers
4. Describe designing, building and testing of common combinational circuits
5. Describe designing, building and testing of common sequential digital logic circuits.
6. Illustrate applications of Ring Counter and Johnson Counter.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in clipping ,clamping wave and working principle of oscillators	1 to 4	1
CO2	Apply the basic knowledge used in operational amplifiers for specific engineering applications.	1 to 3	1
CO3	Identify the different families of digital integrated circuits and working principle of combinational circuits	1 to 2	2
CO4	Analyze the working principle and designing of analog circuits using ORCAD tool	1 to 4	1
CO5	Analyze the working principle and designing of digial circuits using XILINIX tool	1 to 3	1
CO6	Develop the ability to analyze and design analog electronic circuits using discrete components	1 to 4	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1	To simulate a positive clipper, double ended clipper & positive clamper circuits using diodes	Orcad	Simulation of clipper and clamper electronic
2	To simulate a rectangular wave form generator (Op-amp relaxation oscillator) and compare the frequency and duty cycle with the design specifications	Orcad	Simulation of rectangular waveform generator
3.	To simulate a Schmitt trigger using Op-amp and compare the UTP andLTP values with the given specification	Orcad	Simulation of Schmitt trigger
4.	To simulate a Wien bridge Oscillator	Orcad	Simulation of wein bridge oscillator
5.	To determine the working of a power supply and observe the waveforms	Orcad	Simulationof power supply
6.	To build and simulate CE amplifier (RC coupled amplifier) for itsfrequency response and measure the bandwidth.	Orcad	Simulation of RC coupled amplifier and determining the frequency response
7.	Realization of Half/Full adder and Half/Full Subtractors using logic gates	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits
8.	Design and develop VHDL code to realize Full adder and Full Subtractors	Xilinx	Simulation knowledge of the mentioned adders an
9.	Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC	ICs, Trainer kit and patch cords	Realization of a multiplexer
10.	Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working	Xilinx	Simulation knowledge of combinational logic circuit
11.	Design and implement a ring counter using 4-bit shift register and demonstrate its working	ICs, Trainer kit and patch cords	Realization of shift register and ring counter
12.	Design and develop the Verilog / VHDL code for switched tail counter.	Xilinx	Simulation of ring counter

Semester - 4

Course Title	Numerical Methods and Optimization Techniques				Course Type		FC	
Course Code	B23AS0401	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply numerical methods to obtain approximate solutions for mathematical problems.	1 to 3, 12	1
CO2	Determine suitable interpolation formula and quadrature formulae to find the solution for the given data.	1 to 4 ,12	2
CO3	Solve the matrix associated with liner transformation with respect to the given base and understand the relationship between the operation and linear transformations and their corresponding matrices.	1 to 5, 12	3
CO4	Develop mathematical equations with simplex method and Transportation-Assignment problem for linear programming	1 to 5,12	1,2,3

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Numerical Methods: Numerical Solution of Non-Linear Equations-Regula False Method-Newton Raphson Method –Fixed Point Method of Iteration, Relaxation Method and Gauss Seidel Iteration Method.

Application: Nonlinear equations using in simulation and robotics. Particularly machine learning and AI algorithms, such as neural networks and support vector machines, to model complex relationships between input data and output predictions.

UNIT – 2

Numerical Analysis: Interpolation, Newton-Gregory Forward Interpolation Formula, Lagrange's Interpolation Formula, Inverse Interpolation Formula and Newton's Divided Differences Formula**.** Numerical integration**:** Trapezoidal, Simpson's rules and Weddle's rule.

Application: use interpolation functions on zooming low resolution images. Numerical integration helps in Simulations, Systems that analyze user behaviors, Some algorythms related to computer graphics, Some algorythms used in videogames to make the AI take smart decisions.

UNIT – 3

Vector Spaces and Linear transformations: Vector spaces, Subspaces, Linear combination and linear span of set, Linear dependance and independence, Basis and Dimension, Gram-Schmidt orthogonalization. Linear transformations.

Application: Vector Spaces are very important in Data Science, in most Data Science problems you have a dataset in the form of m rows and n columns where each row is a datum, point or observation and each column is a feature or attribute. We analyze vector fields to understand, predict, optimize and build vehicles, electric and electronic devices, climate models, spacecraft, boats, concert halls, bridges, medical devices and economic markets.

UNIT – 4

Linear Programming: Introduction, Canonical and Standard Form of LPP- Graphical method, Simplex Method-Big M Method-. Transportation Problem (North west corner rule) and Assignment problem (Hungerian algorithm).

Application: Linear programming is used in various industries such as shipping industries, manufacturing industries, transportation industries, telecommunications, and others

TEXTBOOKS:

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

REFERENCES

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Professional Ethics				Course Type		FC	
Course Code	B22CS0301	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	2	2	2	28	-	50	50

COURSE OVERVIEW

To enable the students to imbibe and internalize the Values and Ethical Behavior in the personal and Professional lives.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the professional Rules of conduct for Engineers.
2. Appreciate codes of conduct, professional Rules of conduct.
3. Recognize the conflict of interest and Develop strategies.
4. Understand the importance of communication with all stakeholders.
5. Apply practical strategies for handling ethical dilemmas.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understanding basic purpose of profession, professional ethics and various moral and social issues.	8,9,10	2, 3
CO2	Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer	8,9,10	2,3
CO3	Acquiring knowledge of various roles of Engineer In applying ethical principles at various professional levels	8,9,10	2,3
CO4	Professional Ethical values and contemporary issues	8,9,10	2,3
CO5	Apply practical strategies for handling ethical dilemmas	8,9,10	2,3
CO6	Appreciate codes of conduct, professional Rules of conduct	8,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			
CO6	√	√	√			

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – 2

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT- 3

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

UNIT- 4

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, OxfordUniversityPress,2015.

2. Ethics in Engineering Practice &Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

.REFERECE BOOKS:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr.,Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.

2. Business Ethics concepts & Cases: ManuelGVelasquez,6e,PHI, 2008.

Evaluation pattern:

1. Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment
2. Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.
3. Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	**ENTREPRENEURSHIP**				**Course Type**		**FC**	
Course Code	B22CI0309	**Credits**	**1**		**Class**		**IV semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**1**	**3**	**3**	**52**	**0**	**25**	**25**

COURSE OVERVIEW:

NEN Ignite is an entrepreneurship program based on experiential learning that aims to support startups' founders through a structured pathway from Idea Discovery to Pitch Deck.

(A 14 weeks, 36-42 hours of classroom/digital, highly experiential and practice based entrepreneurship training Course, by Wadhawani Foundation and will be delivered by WF facilitators / NEN Trained Entrepreneurship Faculty.)

COURSE OBJECTIVE

1. Discover an entrepreneurial opportunity
2. Articulate a compelling value proposition
3. Build a sustainable business model and business plan
4. Create and validate an MVP with potential customers
5. Select an appropriate Go-to-Market Strategy
6. Pitch the business idea to different stakeholders

COURSE OUTCOMES (COs)

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

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

CO4			**2**						**2**	**2**	**3**	**2**			
CO5			**2**						**2**	**2**	**3**	**2**			

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

UNIT -1

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges. Taking product or service ideas to creating value: Why should one choose to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship.
Orientation for WE Ignite program, Ice Breaking session, self-work Instructions and timelines Platform Demo Introduction to Ignite program flow and milestones , Introduction to Entrepreneurship and Human centred Approach to Design Thinking , Are you enterprising?. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving 100 Rupee Venture; Debrief of Group Activity- Presentation and Sharing Learning Experience

Unit - 2
Entrepreneurial Opportunities: Opportunities. Discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering. Problem Identification and Opportunity Discovery. **Entrepreneurial Process and Decision Making:** Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation **Customer and Markets :** Customer Discovery: Exploring Customer Personas & Market Estimation for your Ideas, Create a compelling value proposition & Competitive Advantage
UNIT- 3
Build your MVP : Building a MVP that customers Love Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas, Introduction to lean start-ups, Business Pitching Business Model: Developing strong business models Create and present your Lean Canvas **Financial Feasibility:** Introduction to Business plan and its components; Basics of Finance.
Unit 4
Institutional Support for Entrepreneurship: Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs **Go To market Strategy:** Getting products to market: Channels & Strategies; Managing growth and Targeting Scale: Understand the Unit economics for your venture; Funding Strategy: Securing funding for your Startup and Preparing for pitch.

TEXT BOOK

1.Wadhwani Foundation Curriculum K. Ramachandran, “Entrepreneurship Development”, Tata Mc. Graw Hill, 2008.

2.Sangeeta Sharma, “Entrepreneurship Development” PHI Publications, 2016

REFERENCE BOOKS:

1. Baringer and Ireland, “Entrepreneurship”, Pearson, 11th Edition, 2020.

2. Drucker F Peter: “Innovation and Entrepreneurship”, 1985.Heinemann, London.

3.Doanld F Kuratko & Richard M Hodgeth, “Entrepreneurship in the New Millennium”, India Edition - South-Western,

4. Cengage Learning Entrepreneurship –by Robert D. Hisrich (Edition-9)

5.Entrepreneurship- Theory, Process & Practice –by Kuratko & Hodgetts, Thompson South-Western Publication

6.Technology Entrepreneurship Taking Innovation to the Marketplace – by Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, Elsevier

JOURNALS/MAGAZINES

1. International Small Business Journal: **https://journals.sagepub.com/home/isb**

2. Journal of Development Entrepreneurship: **https://www.worldscientific.com/worldscinet/jde**

SWAYAM/NPTEL/MOOCs:

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

Evaluation pattern:

 Internal Assessment-1 will be conducted as a subjective test for 25 Marks which covers Unit-1 and Unit 2 of the syllabus. This exam will be conducted during IA-1 examinations slot.

 Internal Assessment-2 will be conducted as a subjective test for 25 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot.

 Semester End Exam will be conducted for 50 Marks and evaluation is based on the subjective test of unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	Environmental Science				Course Type		MC	
Course Code	B22AS0403	Credits	0		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	0	1	1	14	-	50	50

COURSE OVERVIEW

Environmental Science is focussed on a holistic understanding of earth systems in order to learn from the past, comprehend the present and influence the future. It is the study of how physical, chemical and biological processes maintain and interact with life, and includes the study of how humans affect nature. As environmental science is at the cross-roads of the natural sciences, it provides an enriching alternative to a single-subject honours degree, and can open the door to an exciting range of career options. This approach enables us to tackle necessary problems, such as ensuring that human needs are met in a sustainable way, so that everyone has access to clean water and air, and the resources required for agriculture and industrial activity.

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	7,9,10	**1**
CO2	List the causes, effects & remedial measures of environmental pollution, degradation & find ways to overcome them by suggesting the pollution controlled products.	7,9,10	**1**
CO3	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	7,9,10	**1**
CO4	Critically analyse the ecological imbalances and provide recommendations to protect the environment.	7,9,10	**1**

CO5	Explore the condition of environmental degradation and waste management techniques and take promising measures to make our environment eco-friendly.	7,9,10	**1**
CO6	Identify new methodologies for conservation of our natural resources and ecosystem.	7,9,10	**1**

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

Contents

UNIT-1

Environment and Environmental Protection

Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment. **Environmental protection:** Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations.

UNIT-2

Environmental pollution, degradation & Waste management:

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

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

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

UNIT-3

Energy & Natural resources:

Energy: Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, 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. Forest wealth - Importances, Deforestation-Causes, effects and controlling measures

UNIT-4

Ecology, ecosystem & field work:

Ecology - Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Components of ecosystem-abiotic and biotic.

Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity.

Field work: Visit to waste water/sewage treatment plant (STP) and biogas plant at REVA university campus, and/or Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

TEXT BOOKS:

1. R .J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, Co-authored &Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.
2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2nd Edition, 2014
3. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008
4. Dr.S.M.Prakash, "Environmental Studies", Elite Publishers, Mangalore, 2nd Edition, 2009
5. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, New Delhi, 3rd Edition, 2016

Examination Pattern:

The course is Mandatory course, As per the regulations 23-24 no IA tests or assignments for the course evaluation. Semester End Examination question paper is of MCQ pattern set for maximum marks of 50. Marks obtained is scaled down to 25.

Links for EVS Online resources

Link for online	Title of the course	Course Duration
https://www.classcentral.com/course/swayam-environmental-studies-14042	**Environmental Studies**	**12 Weeks Free Online**
https://www.edx.org/course/introduction-to-environmental-science-2?index=product&search_index=product&webview=false&campaign=Introduction+to+Environmental+Science&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science	**Introduction to Environmental Sciences**	**5hrs/Week For Weeks**
https://www.coursera.org/specializations/environmental-science?action=enroll	**Introduction to Environmental Science Specialization**	**5hrs/Week 12 Weeks**

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Course Title	Computer Organization and Architecture				Course Type		HC	
Course Code	B22CI0401	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**0**	**0**	**42**	**0**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE(S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of ARM processor instruction set for developing simple assembly programs.	1,2,7,12	1
CO2	Interpret the functional architecture of computing systems.	1,2,4,10	1
CO3	Identify the issue related to instruction set architecture, memory unit and control unit and I/O functions.	1,11	1
CO4	Develop a real world application using parallel processing concepts.	1,2,4,10,11	1,2
CO5	Learn new tools and technologies and apply for suitable application development.	12	1

CO6	Develop solutions in the Computer Architecture and Organization to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 6, 10	1, 2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

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 – 2
Introduction to ARM processor: Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer and Internet of Things (IoT). ARM characteristics, Register structure, Addressing modes, Instructions, Assembly language, Operating Modes and Exceptions, Conditional execution of Instructions.
UNIT – 3
Memory System: Basic concepts, Synchronous RAM memories, Read-only memories, Direct Memory Access, Memory Hierarchy, Cache memories, Virtual memory.
UNIT – 4
Input/output Organization: Bus structure, Bus operation, Arbitration, Interface circuits, Intercommunication standards. **Parallel processing**: Hardware multithreading, Vector (SIMD) processing and Shared Memory multiprocessors.

TEXTBOOKS:

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

REFERENCEBOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Design and Analysis of Algorithm				Course Type		HC	
Course Code	B22CI0402	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	1	2	2				
	Total	**4**	**5**	**5**	**42**	**-**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs):

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1
Introduction-Notion of an Algorithm; Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms.
UNIT – 2
Brute Force: Bubble Sort, Selection Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search, Divide-and-Conquer: Merge sort, Quick sort, Multiplication of Large Integers, Decrease-and-Conquer- Insertion Sort, Topological Sorting.

UNIT – 3
Greedy Technique-Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm Dynamic Programming-Fibonacci numbers, Binomial coefficient, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms
UNIT – 4
Space and Time Trade-Offs- Sorting by Counting, Input Enhancement in String Matching,, Coping with the Limitations of Algorithm Power- Backtracking-n-Queens Problem, Subset-Sum Problem, Branch-and-Bound, Assignment Problem, Travelling Salesman Problem

TEXTBOOKS:

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

REFERENCEBOOKS:

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

2. ACM Transactions on Algorithms.

3.ACM Journal of Algorithms and Computational Technology.

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

1. More exploration on GIThub

Course Title	Database Management System				Course Type		HC	
Course Code	B22CI0403	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

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

COURSE OBJECTIVE(S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs):

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

CO4			√			
CO5			√			
CO6			√	√		

COURSE ARTICULATION MATRIX:

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

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

COURSE CONTENT

THEORY:

UNIT – 1

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

UNIT – 2

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

UNIT – 3

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

UNIT – 4

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Programming with JAVA				Course Type		HC	
Course Code	B20CI0302	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1

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

UNIT – 2

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

UNIT – 3

Inheritance and Exceptions: Extending a Class; Object: The Cosmic 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

1. The Eclipse-IDE

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

Course Title	Design and Analysis of Algorithms Lab				Course Type		HC	
Course Code	B22CI0405	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of mathematical foundation for the analysis of algorithms.	1 to 5, 12	1,2
CO2	Develop a program to solve the given real world problems using brute force and divide and conquer design paradigm.	1 to 5,12	1,2
CO3	Make use of greedy and dynamic programming techniques for solving the given real world problem.	1 to 5,12	1,2,3
CO4	Utilize backtracking and branch and bound techniques to solve real world problems.	1,to 5,12	1,2,3

CO5	Learn new tools and technologies in the Desiging of algorithms and apply for suitable application development.	12	1
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX

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

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

Exp. No	PROBLEM STATEMENT
1	Search for a given pattern in a text string using Brute Force String Matching.
2	Sort a set of elements in ascending order using Quick Sort algorithm.
3	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's
4	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithms. Differentiate the methods.

5	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra's algorithm
6	Design and Implement 0/1 Knapsack problem using Dynamic Programming.
7	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm
8	Obtain the DFS ordering of vertices in a given digraph.
9	Implement Horspool's algorithm for String Matching and find the number of key comparisons in successful search and unsuccessful search
10	Sort a given set of elements in ascending order which has duplicate entries. Use the sorting by counting algorithm
11	Implement N Queen's problem using Back Tracking.
12	Write a program to sort all transactions of Big Mall by quantity of sales.
13	Write a program to find network of people of same location in Linkedin social network

Exp. No	**EXERCISES PROBLEM**
1.	Sort a list of products in an e-commerce platform based on their prices or ratings.
2.	You are a logistics manager for a shipping company responsible for ensuring efficient routes between multiple warehouses. The company has warehouses in different cities, and you need to determine the feasibility of establishing direct shipping routes between them. However, due to various factors such as distance, road conditions, and traffic, some routes might not be directly accessible. Address the problem using Warshalls Algorithm.
3.	Find a subset of a given set S = {s1, s2,….., sN} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
4.	You are tasked with optimizing the delivery routes for a newly established e-commerce company called "SwiftCart".Consider the following scenario implement Dijkstra's algorithm to find the shortest path between different districts in the city. The city map consists of nodes representing intersections and edges representing streets connecting these interscetions.Each street has an associated distance (in kilometers) that represents the length of the street.There are specific districts within the city where customers reside, and there is a central distribution center where the products are stored and dispatched.The delivery vehicles can only travel on designated streets and intersections. Some streets may be one-way, and vehicles cannot travel against the flow of traffic.Additionally, there may be traffic congestion and road closures that need to be considered dynamically. Your task is to design an algorithm that efficiently finds the shortest path for SwiftCart delivery vehicles to travel from the distribution center to various customer districts. Your goal is to implement **Dijkstra's algorithm** to find the shortest path between different districts in the city. Consider the following scenario: The city map consists of nodes representing intersections and edges representing streets connecting these intersections. Each street has an associated distance (in kilometers) that represents the length of the street.

	There are specific districts within the city where customers reside, and there is a central distribution center where the products are stored and dispatched. The delivery vehicles can only travel on designated streets and intersections. Some streets may be one-way, and vehicles cannot travel against the flow of traffic. Additionally, there may be traffic congestion and road closures that need to be considered dynamically. Your task is to design an algorithm that efficiently finds the shortest path for SwiftCar delivery vehicles to travel from the distribution center to various customer districts
5.	Implement a Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted. The elements can be read from a file or can be generated using the random number generator.
6.	You are working as a project manager for a software development company. Your team has been assigned a critical project that requires the development of a web-based application for a client. The project involves various tasks such as frontend development, backend development, database design, testing, and deployment. You have a team of skilled developers, each with different expertise and availability. Your task is to **assign** the developers to the tasks in such a way that the project can be completed as quickly as possible while ensuring that each developer is assigned only one task at a time.
7.	You are developing a task scheduling application that manages dependencies between tasks. Each task has a unique identifier and may depend on one or more other tasks to be completed before it can start. You decide to use topological sorting to determine the order in which tasks should be executed to satisfy all dependencies. Your application receives a list of tasks along with their dependencies. Tasks are represented by their unique identifiers (e.g., Task A, Task B, Task C), and dependencies are represented as pairs where the first task must be completed before the second one can start. For example, the input might look like this: Tasks: [Task A, Task B, Task C, Task D, Task E] Dependencies: [(Task A, Task B), (Task A, Task C), (Task B, Task D), (Task C, Task D), (Task D, Task E)] Your task is to implement the **topological sorting** algorithm to determine the order in which the tasks should be executed, considering their dependencies. If there's a cycle in the dependencies (which would make it impossible to determine a valid order), your algorithm should detect and handle it appropriately.
8.	Write a Program to perform Binary Search for a given set of integer values non recursively and recursively.
9.	A newspaper agent daily drops the newspaper to the area assigned in such a manner that he has to cover all the houses in the respective area with minimum travel cost.
10.	You are a traveler preparing for an adventure through the wilderness. You have a backpack with a limited capacity, and you want to pack it with items that will help you survive and thrive during your journey. Each item has a weight and a value associated with it.Your goal is to maximize the total value of the items you pack into your backpack without exceeding its weight capacity. Here are the details of the items available for you to pack: **Map** Weight: 2 kg Value: Rs 10 **Water Bottle** Weight: 3 kg Value: Rs 7 **Energy Bars** Weight: 1 kg Value: Rs 5 **First Aid Kit** Weight: 4 kg

	Value: Rs 15 **Flashlight** Weight: 2 kg Value: Rs 8 Mult**i-tool** Weight: 5 kg Value: Rs10 Your backpack can hold a maximum weight of 10 kg. Apply Knapsack algorithm to solve the problem.

Course Title	Database Management System Lab				Course Type		HC	
Course Code	B22CI0406	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW:

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

COURSE OBJECTIVE(S):

The objectives of this course are to:

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

COURSE OUTCOMES(COs):

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

CO6			√	√		

COURSE ARTICULATION MATRIX:

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

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

PRACTICE:

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

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

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

Course Title	Programming with JAVA Lab				Course Type		HC	
Course Code	B22CI0407	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2

CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PART A- PRACTICE PROGRAMS

1.	Write a java program to create a console application that allows the user to choose an arithmetic operation able to provide his choice of operands for the same. Display the appropriate output. Note: Use switch statement to perform the operations. Aim: Implementation of Simple Calculator

2.	String is a collection of characters, a given string can be a combination of vowels and consonants. Develop a java program to count the number of vowels and consonants in a string. Aim: Count Vowels and Consonants in a given string.
3.	Using a one-dimensional array, read an array of integer elements and perform the following operations. a. Copy all elements from one array to another. b. Remove duplicate elements from array and print only even position of array.
4.	Develop a JAVA program to write an application to create student database to input name, SRN and college name, where college name should be declared as static variable and perform the following tasks. Create a class with static variable. Insert some values into the members of the class including static member and display the values of the members. Change the value of static variable and display the updated values of the members. Aim: Implement Static Variable for a Student database
5.	Volume of a box to be computed using different features of a box: height, width, and depth. Write a generic java program that accepts the values of the features of a box during the construction of its object and calculate its volume and display the same. Note: Student should identify the classes, data and function members in each class and write the program. Aim: Implementation of constructor to calculate the volume of a box
6	A child inherits the features of parents and develops its own personality as it grows up in the society, over a period of time. This situation can be represented by the concept of multilevel inheritance in java programming. Apply the same concept in the car manufacturing scenario in your own terms. Aim: Construct multilevel inheritance
7	XYZ technologies is a firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize its payroll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. Income Tax is 40% of gross salary for all employees. The annual increments to the employees are to be given of the following criteria: -Manager 10% of the basic salary, and Technicians 15% of basic. Develop the pay roll for XYZ. Implement a class hierarchy using inheritance, where Employee is an abstract class and Manager and Technician are derived from Employee. Demonstrate a polymorphic behavior for giving the annual increments. Aim: Develop multiple inheritance using Interfaces
8	Define a new Exception class named Odd Exception. Create a new class named Even Odd. Write a method called halfOf(), which takes an int as parameter and throws an Odd Exception if the int is odd or zero, otherwise returns (int / 2). Write a main method that calls halfOf() three times (once each with an even int, an odd int, and zero), with three try/catch blocks, and prints either the output of halfOf() or the caught Odd Exception. Aim: Demonstration for handling multiple exceptions and nested try blocks
9	Develop a Java program, to check the validity of voting customer by providing customer's age as input using custom JAVA exception.
10.	Develop a Java program to create a simple generic class, where T is a type parameter that will be replaced by a real type, when an object of type Gen class is created.

PART B- Sample Exercise Programs

1	Write a Java program that reads a floating-point number and prints "zero" if the number is zero. Otherwise, print "positive" or "negative". Add "small" if the absolute value of the number is less than 1, or "large" if it exceeds 1,000,000.
2	Duck number is another special positive non-zero number that contains zero in it. The digit zero should not be presented at the starting of the number. Zero can be present at any of the positions except the beginning of the number. Develop a java program to check given 2 numbers are valid Duck numbers or not.
3	Consider a list containing marks of 30 students, Program to find the frequency of each student who got marks more than 90.
4	LinkedList implements the Collection interface. It uses a doubly linked list internally to store the elements. It can store the duplicate elements. Develop a Java program to make use linked list collection to add elements and display elements using iterator class.
5	Implement a Java program to handle ATM transactions. a) The user must select an option from the options displayed on the screen. b) The options are related to withdraw the money, deposit the money, check the balance, and exit.
6	Develop a Java program to implement a lambda expression to sort a list of strings in alphabetical order.
7	Deadlock is a scenario in a multi-threaded Java environment where two or more threads are blocked forever. Develop a java program create a deadlock scenario programmatically.
8	Implement a java program to create different ways of pyramid patterns.
9	Implement a Java program to get the current local date, time and check current year is leap year or not.
10	Write a Java program to create class called "TrafficLight" with attributes for color and duration, and methods to change the color and check for red or green.

Semester – 5

Course Title	Indian Heritage and Culture				Course Type		Theory	
Course Code	B22ED0501	Credits	0		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	2	2				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	0	2	2	28	0	50 %	50 %

COURSE OVERVIEW

India is one of the ancient civilizations of the world which has stood the test of time. In fact what makes Indian culture unique among other ancient civilizations is its ability to accommodate and assimilate external influences and weave them into its own cultural fabric. This composite influence has not only enriched the cultural milieu of India, it has also made it stronger. Indian art, architecture, music, language, philosophy and religion reflect this diversity of influence that has occurred through centuries. This is the beauty of Indian Culture and Heritage. As Indian citizens not only do we need to be proud of this pluralistic and rich cultural heritage but also to study it objectively and assess it critically.

Course Objectives:

1. To provide conceptual knowledge of Indian culture.
2. To acquire the knowledge of history of ancient India,
3. To introduce students to the history related to Indian culture through ages.
4. To illustrate the unity and the underlying diversity in the Indian languages.
5. To help students understand the religions movements in ancient India.
6. To help learners understand the factors which unite the religion and philosophy of India.

Course Outcomes:

On completion of the course students will be able to:

Describe the distinctive features of Indian culture; identify the central points and uniqueness of Indian culture.

1. Understand the concept and meaning of culture and establish the relationship between cultures through the ages.
2. Develop an awareness of the variety of languages and literature in India.

3. Examine the relationship between socio-cultural changes in the Indian society and the literature in different Indian languages.
4. Identify the characteristics of various religious movements in ancient India.
5. Examine the contributions of various philosophies.

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		√	√			
CO2	√	√			√	
CO3		√				
CO4			√		√	
CO5		√				√
CO6				√	√	

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY

Unit - 1 Culture
Culture: Concept of culture, culture and civilization, culture and heritage, general characteristics of culture, Importance of culture in human life, Characteristics of Indian culture, Culture and civilization, Culture and heritage, General characteristics of culture.
Unit – 2 History and Culture through the Ages
Importance of studying history, ancient India, Vedic culture, popular religious reforms, the Persian invasion and its impact on Indian culture, the Greek (Macedonian) invasion and its impact on Indian culture, Ashoka the great : representing the acme of Indian culture, art, and architecture: Mauryan beginnings, post - Mauryan cultural developments.
Unit – 3 Languages and Literature
Indian languages: the role of Sanskrit, the Vedas, the Upanishads, the Ramayana, and the Mahabharata, puranas, Buddhist and Jain literature in Pali, Prakrit and Sanskrit, other Sanskrit literature, Telegu, Kannada and Malayalam literature, Tamil or Sangma literature, northern Indian languages & literature - Persian and Urdu.
Unit – 4 Religion and Philosophy
Religion, Pre-Vedic and Vedic religion, unorthodox religious movements, theistic religions, folk cults Vaishnava, movement in the south, Shaivism, minor religious movements, Vedic philosophy, Charvaka school, Jain philosophy, philosophy of the buddha.

Textbooks

1. Sundararajan K.R., Hindu Spirituality - Vedas through Vedanta, Cross Road Publications, New York, 1997.
2. Griffiths Bede, Yoga and the Jesus Prayer Tradition, Asian Trading Corporation, Bangalore, 1992.
3. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998.
4. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.
5. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018.

Course Title	Machine Learning				Course Type		Theory	
Course Code	B22CI0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW:

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

COURSE OBJECTIVES:

The objectives of this course are to:

1.Explain machine learning and problems relevant to machine learning.

2.Discuss the fundamentals of Decision trees learning and its issues

3.Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.

4.Describe statistical analysis of machine learning techniques.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts.	1 to 5	1,2,3
CO2	Implement suitable classification technique for intelligent applications	1 to 5	1,2,3
CO3	Implement clustering algorithms for intelligent applications	1 to 5	1,2,3
CO4	Implement machine learning algorithms for intelligent applications	1 to 5	1,2,3
CO5	Learn new tools and technologies related to machine learning and apply for suitable application development.	10,12	2,3
CO6	Develop solutions using machine learning based algorithms for the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	11,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

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

TEXT BOOKS:

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

Websites:

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

RECOMMENDED LEARNING RESOURCES (REFERENCE BOOKS):

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2nd edition, springer series in statistics.

2. Ethem Alpaydın, “Introduction to machine learning”, second edition, MIT press.

JOURNALS/MAGAZINES:

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

SWAYAM/NPTEL/MOOCs:

1. Coursera – Machine Learning
2. Coursera – Deep Learning
3. https://onlinecourses.nptel.ac.in/noc19_cs53/preview

SELF-LEARNING EXERCISES:

Reinforcement Learning: Introduction, Learning Task, Q Learning

Course Title	Computer Networks				Course Type		Theory	
Course Code	B22CI0502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE(S):

The 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.
5. Emphasis the management of local area networks
6. Learning about computer network organization and implementation

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1to6,12	1
CO2	Identify the good network design with simplicity, scalability, performance and the end-to-end principle.	1to6,12	1
CO3	Appraise the working principles of Internet.	1to6,12	1
CO4	Develop applications using network protocols.	1to6,12	1,2,3
CO5	Emphasis the management of local area networks	1to6,12	2,3
CO6	Learning about computer network organization and implementation	1to6,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

Contents
UNIT-1
Introduction to Data Communication and Networking: Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols &Standards, 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, Shannon 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. Transmission Media. **Error Detection and Correction**: Introduction, cyclic Codes: Cyclic redundancy code generation. 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 Wi-Fi, 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 Go Back-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.

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.

JOURNALS/MAGAZINES:

1. IEEE Transactions on Networking.
2. Elsevier Journal of Computer Networks
3. Springer Journal of communications and Information networks.

SWAYAM/NPTEL/MOOCS:

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

SELF LEARNING EXERCISES:
Remote Login. Protocols: TELNET Protocol and SSH Protocol. Electronic Mail (E-Mail), World Wide Web (WWW).

Course Name	Web Technologies & Applications				Course Type		Theory	
Course Code	B22EJ0503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW:

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

COURSE OBJECTIVE(S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Course Contents

Theory

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES:

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

SWAYAM/NPTEL/MOOCS:

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

SELF LEARNING EXERCISES:

HTML5, JQuery, XML, Ruby, Introduction to REST and REST ful API

Course Title	Operating Systems				Course Type		Theory	
Course Code	B22CI0503	Credits	3		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	IA	SEE
	-	-	-	-				
	Total	3	3	3	42	-	**50%**	**50%**

COURSE OVERVIEW:

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.

COURSE OBJECTIVE(S):

1: Explain the major components and different services of Operating system

2: Implement process management and scheduling schemes.

3: Discuss synchronization and deadlock techniques in real time applications.

4: Demonstrate memory management techniques for a given machine architecture

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the major components and different services of Operating system	1-3	1
CO2	Evaluate the Performance of different CPU Scheduling algorithm for the given real world applications	1-5	1
CO3	Build applications to overcome synchronization problems and to avoid deadlocks	1-3,5	2,3
CO4	Compare the physical and virtual memory management techniques and interpret the file systems concepts	1-5	2,3
CO5	Understand fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.,	1-5	2,3
CO6	Explain the performance trade-offs inherent in OS implementation	1-5,9	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

COURSE CONTENT

THEORY

Contents
UNIT-1 **Operating System Principles:** what Operating Systems do, Computer System organization, computer system architecture, Operating System structure, 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. Threads: Overview, Multicore programming, Multithreading models, Thread Libraries, threading issues. **Process Synchronization**: Background, 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.
UNIT-3 **CPU Scheduling:** Basic concepts, scheduling criteria, Scheduling algorithms, Multiple Processor scheduling, thread scheduling. **Deadlock**: Definition, Deadlock characteristics, methods of handling deadlocks, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.
UNIT-4 **Memory Management**: Background, Swapping, contiguous memory allocation, Paging, structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, copy-on-write, Page replacement, Allocation of frames, Thrashing. **File System Interface**: File concept; Access methods; Directory and disk structure; File system mounting; File sharing; Protection.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 9th edition, Wiley-India, 2012.

REFERENCE BOOKS:

1. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
2. Andrew Tanenbaum & Albert Woodhull, Operating Systems: Design and Implementation. Prentice-Hall, Third edition, 2014.
3. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
4. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE),2014.

JOURNALS/MAGAZINES:

1. S. Pamplona, N. Medinilla and P. Flores, "A Systematic Map for Improving Teaching and Learning in Undergraduate Operating Systems Courses," in *IEEE Access*, vol. 6, pp. 60974-60992, 2018, doi: 10.1109/ACCESS.2018.2871768.
2. Y. Liu, Z. Yu, B. Guo, Q. Han, J. Su and J. Liao, "CrowdOS: A Ubiquitous Operating System for Crowdsourcing and Mobile Crowd Sensing," in *IEEE Transactions on Mobile Computing*, vol. 21, no. 3, pp. 878-894, 1 March 2022, doi: 10.1109/TMC.2020.3015750.
3. P. Li, Binoy Ravindran, S. Suhaib and S. Feizabadi, "A formally verified application-level framework for real-time scheduling on POSIX real-time operating systems," in *IEEE Transactions on Software Engineering*, vol. 30, no. 9, pp. 613-629, Sept. 2004, doi: 10.1109/TSE.2004.45.

4. F. Ugalde Pereira, P. Medeiros de Assis Brasil, M. A. de Souza Leite Cuadros, A. R. Cukla, P. Drews Junior and D. F. Tello Gamarra, "Analysis of Local Trajectory Planners for Mobile Robot with Robot Operating System," in *IEEE Latin America Transactions*, vol. 20, no. 1, pp. 92-99, Jan. 2022, doi: 10.1109/TLA.2022.9662177.

SWAYAM/NPTEL/MOOCs:

1. https://archive.nptel.ac.in/courses/106/105/106105214/ (Operating System fundamentals)
2. https://www.coursera.org/courses?query=operating%20system (Introduction to operating system)
3. https://www.udacity.com/course/introduction-to-operating-systems--ud923 (Introduction to Operating System)

SELF-LEARNING EXERCISES

Virtual machines and Introduction to Linux Operating System, Introduction to Distributed computing, Parallel computing, grid computing, cloud computing.

Course Title	Advanced Database Systems (PE-I)				Course Type		Theory	
Course Code	B22EJS501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 Hrs/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Advanced database system deals with current and emerging technologies which enables to handle complex applications, provides a comprehensive understanding of data modelling techniques, OLAP, OLTP, Data warehouse and its practical implementation.

COURSE OBJECTIVE (S):

1 Discuss object-oriented concepts and object relational data bases
2 Describe Parallel and distributed database.
3 Illustrate queries for distributed data storage and processing.
4 Explain enhanced data models for applications

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the features of Object Definition Language and Object Query Language for given real world applications	1 to6	1
CO2	Develop Complex queries in SQL and ODMG for parallel and distributed databases.	1 to6	1
CO3	Make use of different types of databases and other technologies to mine the data.	1 to6	1
CO4	Design multi dimension model for a given application in Data mining.	1 to6	1,2,3
CO5	Understand of data modelling techniques, OLAP,OLTP	1-6	1,2
CO6	Practical implementation of advanced data base system	1-6	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

Contents
UNIT-1
Introduction to various tools and frameworks: Introduction to OLAP, OLTP and Data warehouse system, data modelling, star schema, snowflake schema. Build Data warehouse/data mart using opensource tools like pentaho data integration tool, pentaho business analytics. OLAP versus OLTP, Introduction tovarious tools Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.

UNIT-2
Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.
UNIT-3
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases - Basic concepts
UNIT-4
Data Warehousing and Data Mining: Introduction to decision support, OLAP, multidimensional model, Window queries in SQL, finding answers quickly, Implementation techniques for OLAP, Data Warehousing, Introduction to Data Mining, Counting co-occurrences, Mining for rules, Tree-structured rules, Clustering, Similarity search over sequences, Incremental mining and data streams;

TEXTBOOKS:

1. 1.Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw- Hill, 2003.
2. 2.Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
3. 3.Jiawei Han, MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier, 2011.

REFERENCEBOOKS:

1. 1.Connolly and Begg, "Database Systems", 4th Edition, Pearson Education, 2002.

JOURNALS/MAGAZINES:

1. https://dl.acm.org/journal/jdiq
2. https://dl.acm.org/journal/tkdd
3. https://dl.acm.org/journal/tods
4. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69
5. https://www.springer.com/journal/10618

SWAYAM/NPTEL/MOOCs:

1. Coursera – Database Management Essentials, University of Colorado System
2. Coursera – Databases and SQL for Data Science, IBM
3. https://www.edx.org/course/advanced-database-administration
1. https://www.edx.org/course/olap-and-recursion
2. https://www.edx.org/course/advanced-database-queries

Self-Learning Exercises:

1. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management, P-P database.
2. Transaction management.

Course Title	Agile Software Development and DevOps (PE-I)				Course Type		Theory	
Course Code	B22CJS502	Credits	3		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	3	3	3	42	0	50	50

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

After thecompletionof the course, the student will be able to:

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

UNIT – 1
Introduction Defining the Software Development Process: Goals of Defining the Software Development Process , Why Is Defining the Software Development Process Important? , Where Do I Start?, Explaining the Software Development Lifecycle , Systems versus Software Development Life cycle Defining Requirements, Managing Complexity and Change, Validity of Requirements, Testing Requirements ,Functional Requirements, Non functional Requirements, Epics and Stories, Planning for Changing Requirements , Workflow for Defining Requirements ,Test- Driven Development , Designing Systems ,Software Development ,Testing , Testing the Application ,Testing the Process Itself , Continuous Integration , Continuous Delivery and Deployment , Defining Phases of the Lifecycle ,Documentation Required , DevOps , Communicating with All Stakeholders, Production Support ,Maintenance and Bugfixes, Lifecycle in the Beginning ,Maintenance of the Lifecycle ,Creating the Knowledge Base.
UNIT – 2
Agile Application Life cycle Management: Goals of Agile Application Life cycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD?, Focuson12 Agile Principles, Agile Manifesto, Fixed Time box Sprints, Customer Collaboration, Requirements and Documentation.
UNIT – 3
Automating the Agile ALM: Goals of Automating the Agile ALM, Why Automating the ALMIs Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, What Do I Do Today?, Automating the Workflow, Process Modelling Automation, Managing the Lifecycle with ALM, Broad Scope of ALM Tools ,Achieving Seamless Integration ,Managing Requirements of the ALM, Creating Epics and Stories, Systems and Driven Development, Environment Management, Gold Copies, Supporting the CMDB, Driving DevOps ,Supporting Operations ,Help Desk ,Service Desk ,Incident Management , Problem Escalation ,Project Management, Planning the PMO ,Planning for Implementation, Evaluating and Selecting the Right Tools, Defining the Use Case, Training Is Essential, Vendor Relationships, Keeping Tools Current.
UNIT – 4
DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOp sinDev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

TEXTBOOKS:

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

REFERENCEBOOKS:

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs:

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

Self-Learning Exercises:

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

Course Title	Human Computer Interaction (PE-I)				Course Type		Theory	
Course Code	B22EJS503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course presents the foundations of Human Computer Interaction (HCI). The contents are structured into phases comprising: Basic definitions and motivations of HCI, interaction paradigms, design principles and models, User-centred design methods comprising user studies, design approaches for interfaces and interaction, evaluation methods and techniques for data analysis, Research frontiers of HCI, including accessibility, universal design, and pervasive computing (ubiquitous, mobile and wearable computing).

COURSE OBJECTIVE (S):

The overall objective of the Course is as follows:

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)

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the suitable positioning and pointing device to be used to work with the given application.	1 to5	1
CO2	Develop the user interface by Selecting an effective style for the given real world applications.	1 to5	2
CO3	Make use of different UI design rules to develop a user interface for a real-world application.	1 to5	3
CO4	Compare the different evaluation techniques used to measure the quality of User Interface.	1 to5	1
CO5	Demonstrate the use of an interactive design process and universal design principles in designing HCI systems.	1 to5	2

CO6	Illustrate the use of different evaluation methods	1 to5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

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

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

COURSE CONTENT
THEORY

Contents
UNIT-1 **Introduction to Human and the Computer**: Human: Input-output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks.
UNIT-2 **The interaction and Paradigms:** Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction. **Paradigms:** Paradigms for interaction. Interaction design basics: The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.
UNIT-3 **HCI in the software process and Design rules**: The software life cycle, Usability engineering, Iterative design and prototyping. Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Universal designs.
UNIT-4 **Evaluation techniques**: Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method.

TEXT BOOKS:

1. Dix, Janet Finlay, Gregory Abowd & Russell Beale, "Human-Computer Interaction", 3rd Edition. Prentice Hall, 2004.
2. Julie A. Jacko, "Human-Computer Interaction Handbook", 3rd Edition, CRC Press, 2012.
3. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface", 6th Edition, Addison Wesley, 2017.

REFERENCE BOOKS:

1. 1.Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser," Research Methods in Human- Computer Interaction", Wiley, Second edition, 2010

JOURNALS/MAGAZINES:

1. ACM, International Journal of Human-Computer Studies, 2003.
2. IEEE, Transactions on Human-Machine Systems, 2014
3. Elsevier, International Journal of Human-Computer Studies. 2005.

SELF LEARNING EXERCISES:

Designing user support systems, Ubiquitous computing applications research, Hypertext, multimedia and the World Wide Web.

Course Title	UI/UX Design (PE-II)				Course Type		Theory	
Course Code	B22EJS504	Credits	3		Class		V semester	
-	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
Course Structure	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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 OBJECTIVE (S):

The objectives of this course are to:

1. Explain user interface design process for a given problem
2. Illustrate the selection of design; 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):

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the new technologies to design user interfaces for the given real-world application.	1to5,6,7,12	2
CO2	Make use of the UI/UX design process to develop the given real-world application.	1to5,12	2
CO3	Develop applications using various Interaction styles including Direct Manipulation and Virtual Environment.	1to5,12	1
CO4-	Design web and mobile UI/UX based application using structure plane	1to5,12	2
CO5	Describe the assumptions and prototype potential design solutions.	1to5,12	2
CO6	Discuss the issues and challenges to achieving a human-centered design process, especially with regard to user experience design	1to5,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1					2		3	
CO2	3	2	2	2	1							1		3	
CO3	3	3	2	2	1							2	3		
CO4	3	3	2	2	1							2		3	
C-O5	3	3	2	2	1							2	3		
CO6	3	3	2	2	1							2		3	

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

COURSE CONTENT
TH-EORY

Contents
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/UXDesigningfortheDesktop,Mobileandotherdevices.UI/UXDesigningfortheweb.

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- Centred Design for the Web and Beyond, 2nd Edition, New Riders Press,2010.

JOU-RNALS/MAGAZINES:

1. ACM, International Journal of Human-Computer Studies.
2. IEEE, Transactions on Human-Machine Systems.
3. Elsevier, International Journal of Human-Computer Studies.

SELF LEARNING EXERCISES:

Implementation of Common sight patterns in the Interaction design, Prediction of User expectations, Choosing and using the best UI patterns.

Course Title	Block Chain Technology (PE-II)				Course Type		Theory	
Course Code	B22EJS505	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Block chain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called block chain. Block chains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

COURSE OBJECTIVE (S):

1. Describe the basic concepts of Cryptography and Block chain technology.
2. Explain the features of the block chain technology, decentralised applications and smart contract.
3. Demonstrate building of decentralised applications by deploying Smart Contracts
4. Analyse different Block chain Platforms that can be used in real world applications.

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the concepts of block chain technology suitable for given rea world applications	1-9	1
C-O2	Compare the performance of POW and POS mining consensus algorithm with respect to given real world application.	1-11	2
CO3	Build a decentralised application by implementing smart contract using solidity programming language.	1-10	2
CO4	Apply various block chain platforms for solving real world problems.	1-12	2
CO5	Analysis new Block Chain technologies for real world problem	1-11	3
CO6	Prepare the security algorithm for securing block chains	1-12	3

BLOOM'S LEVELOF THECOURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3	2	3	2	0	0	0	3	0	0
CO2	3	3	2	3	2	3	2	3	2	3	3	0	0	3	0
CO3	2	3	3	2	2	3	3	3	3	2	0	0	0	3	0
CO4	2	3	3	2	2	2	2	3	2	3	3	2	0	0	3
-CO5	3	3	2	3	3	3	2	3	3	2	3	0	0	0	3
CO6	3	2	3	2	3	2	3	2	3	1	3	3	0	0	3

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

COURSE CONTENT:

THEORY:

Contents
UNIT-1
Introduction to Cryptography and Block chain: Introduction to cryptography-Symmetric- key cryptography, Public-key cryptography, Digital Signatures and Elliptic Curve Cryptography. **Introduction to Block chain:** Types of Block chain, Structure of a Block, Block Header, Block Header Hash and Block Height, Genesis Block, Linking Blocks in the Block chain, Merkle Trees, Constructing the Block Header. **Mining and Consensus:** The Byzantine general's Problem, Consensus mechanism-proof of work & proof of stake, Bit coin mining and Block chain Forks
UNIT-2
Overview of Ethereum: What Is Ethereum? Compared to Bitcoin, Ethereum: A General-Purpose Block chain, Ethereum Accounts (Externally Owned Accounts and Contracts), Ethereum and Turing Completeness, Decentralized Applications, Decentralized Autonomous Organizations, Smart Contract Introduction, Life Cycle of a Smart Contract.
UNIT-3
Dapp development on Ethereum: Programming Solidity: Structure, Basic Data Types & Statements, Specific Data Types, Data Structures, Memory vs Storage, Access Modifiers, Contract Definition, Functions, Contract Constructor, The Ethereum Contract ABI, Events, Run Ethereum Dapps, Develop a simple smart contract.
UNIT-4
Enterprise Block chains and Applications: Enterprise Block chains: Hyper ledger, R3 Corda, Quorum Block chain Applications: Identity management, Auction, Food industry supply chain and Block chain in Health care.

TEXT BOOKS:

1. Joseph J. Bambara Paul R. Allen," Block chain, A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill Education Professional, Second edition, 2018.
2. Melanie Swan "Block chain: Blueprint for a New Economy", O'Reilly Media, Third edition, Aug 2015.
3. Andreas M. Antonopoulos, Gavin Wood "Mastering Ethereum", O'Reilly Media, Inc.,November 2018.
4. Joseph Holbrook "Architecting Enterprise Block chain Solutions", Sybex, February 2020.

REFERENCE BOOKS:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts "Packt , 2nd edition 2018.
2. Jimmy Cooper, "Block chain Blueprint: Guide to Everything You Need to Know About Block chain Technology and How It Is Creating a Revolution ",Create Space Independent Publishing Platform, 2017.

JOURNALS/MAGAZINES:

1. Deepak Puthal, Nisha Malik, Saraju P Mohanty, Elias Kougianos, Chi Yang, "The Blockchain as a Decentralized Security Framework [Future Directions]" Volume 7, Issue 2, Pages 18 – 21, 2018.
2. Valentina Gatteschi, Fabrizio Lamberti, Claudio Demartini, Chiara Pranteda, Víctor Santamaría," To Blockchain or Not to Blockchain: That Is the Question ", Volume 20, Issue 2 Pages 62 - 74, 2018.
3. Tien Tuan Anh Dinh, Rui Liu, Meihui Zhang, Gang Chen, Beng Chin Ooi, Ji Wang "Untangling Blockchain: A Data Processing View of Blockchain Systems", Volume 30, Issue 7, Pages 1366 –

1385, 2018.
4. Mingjun Dai, Shengli Zhang, Hui Wang, Shi Jin, “A Low Storage Room Requirement Framework -for Distributed Ledger in Blockchain”, Volume 6, Pages 22970 – 22975, 2018.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/104/106104220/
2. https://www.coursera.org/specializations/blockchain

SELF-LEARNINGEXERCISES:

Distributed Ledger in Blockchain, Decentralized Applications.

Course Title	Mobile Application Development (PE-II)				Course Type		Theory	
Course Code	B22EJS506	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course introduces programming technologies, design and development tools related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using OS Software Development Kit (SDK).

COURSE OBJECTIVE (S):

1. Discuss mobile application models/architectures and patterns for development of a mobile software application
2. Demonstrate the installation of software and tools required for development of android applications.
3. Illustrate the use of fundamentals of android with graphics and animation APIs.
4. Describe an application with multimedia concepts of audio, video with entertainment services.

COURSE OUT COMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Android features to develop real world application.	1 to6,9,10	1
CO2	Design a suitable user interface and database for the given real world application.	1 to6,9,10,12	3
CO3	Choose the intrinsic controls required for the development of real world applications.	2 to5,9,10,11	1,2
CO4	Develop Android Services for multimedia, camera and location based activities.	1 to6,9,10,11	2,3
CO5	Discuss mobile application models/ architectures and patterns for development of a mobile software application	1 to6,9,10,12	3
CO6	Demonstrate the installation of software and tools required for development of android applications	1 to6,9,10,11	2,3

BLOOM'SLEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

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

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

COURSE CONTENT
THEORY

Contents
UNIT-1 **Introduction to mobile communication and computing**: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security, Smart phone operating systems and smart phones applications.
UNIT-2 **Fundamentals of Android Application Development:** Introduction to Android., The Android Jellybean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.
UNIT-3 **Layouts, Menus and Graphics in Android**: Menus: Options menu and app bar, Context menu and contextual action mode ,Popup menu, defining a Menu in XML, Creating an Options Menu, Changing menu items at runtime, Creating Contextual Menus, Creating Menu Groups, Adding Menu Items Based on an Intent, Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.
UNIT-4 **Creating the Activity, Working with views:** Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.

TEXT BOOKS:

1. Bill Phillips, Chris Stewart, and Kristin Marsican, "Android Programming: The Big Nerd Ranch Guide", Pearson Technology group,3rd Edition,2015.
2. Barry Burd, "Android Application Development All-in-One For Dummies", Wiley Publisher,2nd Edition, 2012.
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura,"Programming Android: Java Programming for the
4. New Generation of Mobile Devices", Oiley,2nd Edition,2012.

REFERENCE BOOKS:

1. Greg Nudelman, "Android Design Patterns: Interaction Design Solutions for Developer", Wiley, 2013.
2. Jason Tyler, "App Inventor for Android: Build Your Own Apps No Experience Required", Wiley,2011.
3. J.F. Dimarzio, "Android programming with Android studio", wrox,4th edition ,2017
4. 4.Maurice Sharp Erica Sadun Rod Strougo, "Learning iOS Development-A Hands-on Guide to the Fundamentals of iOS
5. Programming", Addison Wesley by Pearson Education, Inc.2014. .Wei-Meng Lee, "Beginning Swift Programming", Wiley India Pvt. Ltd.,2018.

JOURNALS/MAGAZINES:

1. https://www.researchgate.net/publication/303370028_A_Review_Paper_on_Cross_Platform_Mobile_Application_Dev___elopment_IDE
2. igi-global.com/journal/international-journal-mobile-computing-multimedia/1102
3. https://www.researchgate.net/publication/339602524_Framework_for_Developing_Secure_Converged_Web_and_Mobile_Applications

SELF LEARNING EXERCISES:

More Recent Applications: Multimedia;2D graphics ; networking support in Android, Introduction to IoS, App. Development

Course Title	MACHINE LEARNING LAB				Course Type		Theory	
Course Code	B22CI0504	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	**-**	**-**	**-**				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVES:

The objectives of this course are to:

1.Explain machine learning and problems relevant to machine learning.

2.Discuss the fundamentals of Decision trees learning and its issues

3.Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.

4.Describe statistical analysis of machine learning techniques.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts.	1 to 5	1,2,3
CO2	Implement suitable classification technique for intelligent applications	1 to 5	1,2,3
CO3	Implement clustering algorithms for intelligent applications	1 to 5	1,2,3
CO4	Implement machine learning algorithms for intelligent applications	1 to 5	1,2,3
CO5	Learn new tools and technologies related to machine learning and apply for suitable application development.	10,12	2,3
CO6	Develop solutions using machine learning based algorithms for the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	11,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

LAB:

1	**Decision Tree Classifier** Implement and demonstrate a Decision Tree Classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given medical diagnosis dataset.
2	**Feature extraction using Principal Component Analysis (PCA)** Implement and demonstrate the Principal Component Analysis algorithm for dimensionality reduction for any dataset.
3	**K nearest neighbour (KNN)** Implement and demonstrate the k-Nearest Neighbour algorithm (k-NN) to classify the iris data set. Display the Confusion matrix and classification report. Also, try the same algorithm of the social networks dataset to predict a customer can purchase an item or not.
4	**Support Vector Machine (SVM)** Implement and demonstrate a Support vector machine classifier to classify the instances of any dataset.

	Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
5	Short Title: **Regression** Implement and demonstrate linear regression and logistic regression algorithms for any given dataset(s). Visualize the results using graphs. (Salary prediction, Price Prediction)
6	**Random Forest (RF)** Implement and demonstrate a Random Forest classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
7	**K-Means Clustering** Implement and demonstrate the k-means clustering algorithms. Visualize the results using graphs.
8	**Hierarchical clustering** Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
9	**DBSCAN clustering** Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
10	Short Title: **Artificial Neural Networks (ANN)** Implement and demonstrate the two hidden layer multilayer perceptron neural network to any given dataset for classification. Apply two different optimizers or activation functions and compare the results.

TEXT BOOKS:

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

Websites:

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

RECOMMENDED LEARNING RESOURCES (REFERENCE BOOKS):

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2nd edition, springer series in statistics.

2. Ethem Alpaydın, “Introduction to machine learning”, second edition, MIT press.

JOURNALS/MAGAZINES:

1. Springer Journal of Machine Learning.

2. International Journal of Machine Learning and Computing.

SWAYAM/NPTEL/MOOCs:

1. Coursera – Machine Learning

2. Coursera – Deep Learning

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

SELF-LEARNING EXERCISES:

Reinforcement Learning: Introduction, Learning Task, Q Learning

Course Title	**COMPUTER NETWORKS** Lab				Course Type		Theory	
Course Code	B22CI0505	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	**-**	**-**	**-**				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50%**

COURSE OVERVIEW

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

COURSE OBJECTIVE (S):

The objectives of this course are to:

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part - A			
1	a) Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	RJ-45 connector, IO Connector, Crimping Tool, Twisted pair Cable, Cable Tester.	Cable Crimping, Standard Cabling and Cross Cabling, IO connector crimping and testing the crimped cable using a cable tester can be done successfully
	b) Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and Wireless LAN.	NIC, Adapter	Installation and configuration of Wired and Wireless (remotely) NIC and transfer files between systems in LAN and Wireless LAN between two systems in a LAN can be done successfully.
	c) Install and configure Network Devices: HUB, Switch and Routers.	HUB, Switch, Router and configuration software.	Gain the knowledge on configuring the different connecting devices
	d) Connect the computers in Local Area Network.	Computer Systems with connecting media.	Interconnection and building a simple LAN
2	a) Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.	Computer Systems with connecting media.	Configuration of peer to peer network communication
	b) Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	Connected Computer Systems.	Configure Internet connection
	c) Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network	Connected Computer Systems with printer.	File *t*ransfer between systems in LAN using FTP Configuration.
	d) Study of basic network command and Network configuration commands	Command Prompt	Network configuration
3	In information theory and coding theory with applications in computer science and telecommunication, error detection and correction or error control are techniques that enable reliable delivery of digital data over unreliable communication channels. Many communication channels are subject to channel noise, and thus errors may be introduced during transmission from the source to a receiver. Error detection techniques allow detecting such errors, while error correction enables reconstruction of the original data in many cases. Write a Program for Implementation of any one mechanism for Error Detection / Error Correction Techniques.	CRC Hamming Code	Error detection and control in data transmission.
4	A routing algorithm is a procedure that lays down the route or path to transfer data packets from source to the destination. They help in directing Internet traffic efficiently. ... Routing algorithm mathematically computes the best path, i.e. “least – cost path” that the packet can	Distance vector & Link state routing	Routing in networks before the communication begins.

	be routed through Write a Program for Implementation of any routing algorithms.		
Part B: Mini Project 1: Design of Corporate Network			
1	Configuring a Switched network and Study of VLAN's and assigning a PC based on the VLAN.	Windows/Linux OS, Packet Tracer	Switch and VLAN Configuration.
2	Implementing an IP Addressing Scheme Configuring WEP on a Wireless Router. Interpreting Ping and Traceroute Output	Windows/Linux OS, Packet Tracer	Router configuration and connectivity checking.
3	Configuring Static Routing. Configuring Dynamic Routing protocols RIP, OSPF.	Windows/Linux OS, Packet Tracer	Static and Dynamic Routing over a network
4	Examining Network Address Translation (NAT). Configuring a Cisco Router as a DHCP Server	Windows/Linux OS, Packet Tracer	Configuration and working of NAT with setup of DHCP server.
Part C: Mini Project 2: Performance Analysis of TCP and UDP applications over the different Topologies of network			
1	Consider Six nodes and demonstrate the different ways of connecting them in topology methods. Also specify the different transmission media with specific channel specifications.	Python, NS3, Ubuntu.	Create an interface between the devices using different topologies.
2	Configure the IP address of the nodes in the specified network. Achieve the port specifications for different applications. Apply and Demonstrate the TFTP on the specified network using UDP. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the performance using UDP based applications
3	Apply and Demonstrate the FTP and TELNET on the specified network using TCP. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the performance using TCP based applications
4	Apply and Demonstrate the Congestion and Error Controlling mechanism in the specified networks. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the congestion and error controlling in TCP based applications

Course Title	Operating Systems Lab				Course Type		HC	
Course Code	B22CI0506	Credits	1		Class		V Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory							
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	1	2	2	-	28	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objective of this lab is to:

1. Provide the knowledge and skills required to understand Basics of UNIX Operating Environment
2. Describe process concepts and scheduling techniques.
3. Illustrate the use of different memory management techniques of operating system.
4. Describe the data structures and internal representation of files in operating system.

COURSEOUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the scope of UNIX operating environment	1,3	1
CO2	Implementation of scheduling algorithm using C	1,4,5	1,3
CO3	Compare and analyze the performance of different memory management techniques	1,4,5	2,3
CO4	Make use of file types, file structure and file system implementation. .	1,2,4, 5	1,3
CO5	Learn new tools and technologies in the Designing of algorithms and apply for suitable application development.	1,2,4, 5	1,3
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

PRACTICE:

PART A:			
No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**
1	When the parent process creates a child process, child process can perform any task assigned to it. During the execution of child process, the parent process waits and vice versa. Develop a program in C to create a child process to read commands from the standard input and execute them.	Process creation using fork()	Programming with C
2	Multithreading is a technique, where each thread is assigned with a task and they get executed	Parallel Programming	Programming with C

	simultaneously. For instance, if there are two tasks, two threads are created, one for each task. When one thread is being executed, the other thread waits and vice versa. So, if there are N tasks, N threads can be created one for each task. It works on shared memory technique, where all the threads share the common memory for storing or retrieving the data. Build a program in C to carry out the following tasks i)create two functions, Generate() and Print() to generate the Fibonacci series and print them respectively. ii) Create a separate thread to execute each function. ii) Ensure the synchronization while executing above functions		
3	A policy is applied by a Scheduler to select a process for execution when there is more than one process ready for execution. The policy may be the process which arrives first is executed first **(First Come First Served-FCFS)** or the process which has shortest execution time **(Shortest Job First-SJF)** amongst the set of processes is executed first. Develop a program in C to carry out the following tasks: i) Read a set of processes along with the CPU burst time, arrival time (may be assumed as 0) for each process ii) Allocate the processor to the process which has arrived first (**apply FCFS)** and compute the average waiting time and average turnaround time. iii) Allocate the processor to the process which has shortest CPU burst time (**apply SJF**) and compute the average waiting time and average turnaround time. Compare the performance of both.	Scheduling concept	Programming with C
4	The scheduler may apply different policies to select a process for execution when there is more than one process ready for execution. The policy may be the process which has highest priority (**Priority based scheduling)** amongst all the processes arrived for execution. Develop a program for carrying out the following tasks i) read a set of processes along with the CPU burst time, arrival time (may be assumed as 0) and the priority for each process ii) allocate the processor to the process which has the highest priority and compute the average waiting time and average turnaround time	Scheduling concept	Programming with C

5	Given the list of processes and their CPU burst time, arrival time, the Scheduler may apply a different policy that "each process is given certain amount of execution time called time slice or quantum time" and after completion of time slice, another process in queue is taken for execution. This procedure repeats until all the processes in the list get executed for fixed amount of time. Later, the first process in the queue is selected for the execution once again. This process repeats until the completion of execution of all the processes. **This technique is called Round Robin Technique.** Develop a program for carrying out the following tasks i) read a set of processes along with the CPU burst time, arrival time (may be assumed as 0) and the time slice or time quantum ii) allocate the processor to the processes in the order of their arrival based on arrival time and execute each of them for fixed amount of time (Time quantum). iii) After completion of first round, if execution of processes is not completed, repeat the step ii) iv) compute the average waiting time and average turnaround time	Scheduling concept	Programming with C
6	Consider an example of multi-process synchronization problem, where producer produces the data and stores at some location which will be accessed by another process called Consumer. Since, the producer and consumer share a common, fixed size buffer, there will be a synchronization problem. The solution can be obtained by using semaphores to establish inter process communication with synchronization. Develop a program in C to implement Producer-Consumer Problem by using semaphores to establish inter process communication with synchronization. Create two separate threads, one for producer and another one for consumer. When producer is getting executed, consumer must be in waiting state and vice-versa.	Process synchronization	Programming with C
7	Consider a set of processes, where each process holds some resources with it and requests for some more resources to complete its execution. But, when process P1 is requesting for resource R1 which is being used by P2 and if P2 is requesting for R2 which is held by P1, dead lock occurs and execution does not continue. Banker's Algorithm is used to avoid such deadlocks. Develop a program in C to implement Banker's Algorithm which finds whether the state is safe or not after allocating the resources requested by the processes.	Process synchronization	Programming with C
8	The operating system replaces the old page of a process	Page replacement Algorithm	Programming with C

	whenever a new page of the same process is to be loaded into memory. To select the page for replacement, OS may choose a policy that "the page which has not been used for the longest period of time is to be replaced first". It is termed as Least recently used technique. Develop a C program to implement LRU page replacement algorithm.		
9	When a process with different size arrives to main memory for loading, Find the frame which is larger than the page arrived and store the page in that frame. This strategy is termed as First fit memory allocation technique. Develop a program in C to implement the First fit memory allocation technique.	Memory management	Programming with C
10	The operating system manages storage of information by creating and storing information in the file. The memory required for a new file may be allocated using one of the methods such as Linked list, Indexed or Contiguous method. Develop a C program to implement any one of the file allocation techniques (Linked, Indexed or Contiguous).	File Management	Programming with C

Semester – 6

Course Title	Big Data Analytics				Course Type		Theory	
Course Code	B22EJ0601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course is for those new to data science and interested in understanding why the Big Data Era has come to be. It is for those who want to become conversant with the terminology and the core concepts behind big data problems, applications, and systems. It is for those who want to start thinking about how Big Data might be useful in their business or career. It provides an introduction to one of the most common frameworks, Hadoop, that has made big data analysis easier and more accessible -- increasing the potential for data to transform our world.

COURSE OBJECTIVE (S):

1.Introduce Big Data concepts and managing big data.
2.Describe Hadoop and processing data using Hadoop.
3.Illustrate the use of map-reduce analytics using Hadoop and related tools.
4.Describe Hadoop tools, PIG and Hive architecture

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Big Data in real world applications.	1 to5,9,12	2
CO2	Apply the theories of Hadoop.	1 to5,9,12	2
CO3	Illustrate the fundamental techniques and scalable algorithms like Hadoop, Map Reduce.	1 to5,9,12	1
CO4	Develop a real world application using Hadoop tools	1 to5,9,12	1
CO5	Learn new tools and technologies in the bigdata and apply for suitable application development.	1 to5,9,12	1
CO6	Develop solutions in the bigdata platform to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1 to 5,9,12	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

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

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

COURSE CONTENT

THEORY

UNIT	Syllabus
1	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, top challenges facing big data, why is big data analytics, what kind of technologies are we looking toward to help meet the challenges posed by big data?
2	Unit – 2 **Introduction to Hadoop:** Introducing Hadoop, why Hadoop, why not RDBMS, RDBMS versus Hadoop, History of Hadoop, Hadoop overview, use case of Hadoop, Hadoop distributors, HDFS, Processing data with Hadoop, NoSQL, Hadoop-Features of Hadoop.
3	Unit – 3 **MapReduce:** A weather dataset, Analyzing data with UNIX tools, Analyzing data with Hadoop, scaling out, How MapReduce Works, Anatomy of a MapReduce job run, shuffle and sort, job scheduling.
4	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.

TEXT BOOKS:

1. Sridhar Alla, “Big Data Analytics with Hadoop 3”, published by Packt Publishing Ltd, May 2018.
2. Subhashini Chellappan, Dharanitharan Ganesan,” Practical Apache Spark Using the Scala API”, A Press, 2018.

REFERENCE BOOKS:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj,” Big data, big analytics”, Wiley,2013
2. P. Tan, M. Steinbach, V. Kumar, “Introduction to Data Mining”, Addison-Wesley, 2005.
3. J. Han, M. Kamber, “Data Mining: Concepts and Techniques”, 2nd ed. Morgan Kaufmann, 2005.

JOURNALS/MAGAZINES:

1. IEEE,Introduction to the IEEE Transactions on Big Data
2. Elsevier, Big data research journal Elsevier
3. Springer, Journal on Big Data Springer.
4. ACM DL,The Journal of Machine Learning Research-ACM

SWAYAM/NPTEL/MOOCS:

1. Coursera – Big Data
2. Coursera – Introduction to Big Data
3. https://nptel.ac.in/courses/106/104/106104189/
4. https://www.edx.org/learn/big-data

SELF-LEARNING EXERCISES:

Spark Real-Time Use Case: Data Analytics Project Architecture, Data Ingestion, Data Storage, Data Processing, Data Visualization

Course Title	CLOUD COMPUTING				Course Type		Theory	
Course Code	B22CI0601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14 weeks / Semeste		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The *course* presents a top-down view of *cloud computing*, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for *cloud computing* and large scale distributed systems which form the *cloud* infrastructure.

COURSE OBJECTIVE

1. Introduce cloud computing and provide knowledge in different layers of cloud computing such as: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
2. Describe various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology
3. Explain Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization.
4. Provide knowledge about cloud security and threats

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the cloud computing concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)	1-5	2
CO2	Use various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology	1-5	3
CO3	Apply Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization in developing cloud applications.	1-5,10	1,3
CO4	Analyze cloud security and threats for new problems in hand and develop and p-rovide security services for cloud based applications	1-5, 10,11	2,3
CO5	Learn new tools and technologies in Virtualization and cloud computing concepts and apply for suitable solutions for application development.	12	2,3
CO6	Develop solutions in Virtualization and cloud computing concepts to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT
THEORY

-Contents
UNIT-1
Introduction to Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. **Fundamental Concepts and Models:** Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.
UNIT-2
Cloud Computing Technologies: Broadband networks and internet architecture, data center technology, virtualization technology, web technology, multitenant technology, service technology Cloud Infrastructure **Mechanisms:** Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-made environment

UNIT-3
Specialized Cloud Environment: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-per-use monitor, Audit Monitor, Failover System, Hypervisor, Resource cluster, Multi-device Broker, State Management **Cloud Management Mechanisms:** Remote Adm-inistration System, Resource Management System, SLA Management System, Billing Management System.
UNIT-4
Virtualization: Implementation levels of virtualization, virtualization structures/tools and mechanisms, virtualization of CPU, memory and I/O devices.

TEXT BOOKS:

1. Thomas Erl , Ricardo Puttini , Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI, 2013.
2. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra, Distributed and Cloud Computing, MK, 2012.

REFERENCE BOOKS:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, MK
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms,Wiley.
4. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing, A practical approach, TATA -McGRAW HILL.
5. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications, CAMBRIDGE.
6. David Marshall, Wade A. Reynolds and Dave McCrory, Advanced Server Virtualization-VMware and Microsoft Platforms in the Virtual Data Center, AUERBACH Publications.

JOURNALS/MAGAZINES:

1. International Journal of Cloud Computing, INDERSCIENCE Publishers.
2. IEEE Cloud Computing
3. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

SWAYAM/NPTEL/MOOCS:

1. https://onlinecourses.nptel.ac.in/noc21_cs15/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://www.classcentral.com/course/swayam-cloud-computing-and-distributed-systems-17544

SELF LEARNING EXERCISES:

1. https://www.cybrary.it/course/virtualization-management/
2. http://cds.iisc.ac.in/faculty/simmhan/SE252/
3. https://data-flair.training/blogs/hardware-virtualization-in-cloud-computing/

Course Title	Information and Network Security				Course Type		Theory	
Course Code	B22CI0602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	-Contact Hours	Work Load	14 Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

COURSE OBJECTIVES (S):

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices in Intrusion Detection Systems	1 -5,7-12	1
CO2	Make use of the different cryptographic algorithms for encryption and description of given data.	1 -12	2
CO3	Compare the various performance of protocols used for authentication.	1 -12	2,3
CO4	Identify the suitable firewalls and- IDPS for solving real world network problems	1 -12	1,2,3
CO5	Relate different firewalls available for more security	1 – 12	2,3
CO6	Identify different auditing tools for intrusion management system.	1 -10,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	0	2	3	2	1	2	1	3	0	0
CO2	3	2	3	1	2	1	3	2	1	3	2	0	0	3	0
CO3	3	1	2	2	3	2	3	2	2	3	3	1	0	3	3
CO4	2	2	2	1	1	2	3	2	3	2	3	2	3	3	3
CO5	2	2	3	3	2	3	3	3	2	3	2	3	2	3	3
CO6	2	2	1	3	3	3	3	3	3	2	0	2	0	3	3

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

COURSE CONTENT

Theory:

Contents
UNIT-1
Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blueprint; Contingency plan and a model for contingency plan. **Introduction to Security Technology**: Physical design; Firewalls; Protecting Remote Connections.;

Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools.
UNIT-2
Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security Symmetric Ciphers, Classical Encryption Techniques, Symmetric Cipher Model, -Substitution Techniques, Transposition Techniques, Steganography, Block Ciphers and the Data Encryption, The Data Encryption Standard, ADES Example, Block Cipher Design Principles, Advanced Encryption Standard. Public-Key Crypto systems, The RSA Algorithm, Diffie-Hellman Key Exchange,
UNIT-3
Authentication Applications: Kerberos, X.509 Directory Authentication Service. **Electronic Mail Security:** Pretty Good Privacy (PGP); S/MIME. **Transport level Security, Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches, SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, Cryptographic Computations.
UNIT-4
Firewalls: Introduction, Identification, Authentication, Authorization, Accountability, Firewall processing modes, Firewalls categorized by generation, Firewalls categorized by structure, Firewall architectures, selecting of right firewalls, Content Filters, Protecting remote connections, Remote Access, Virtual Private Networks. **Intrusion Detection and Prevention Systems**: IDPS terminology, use of an IDPS, Types of IDPS, IDPS detection methods, IDPS response, Selecting IDPS approaches and products, Strength and limitations of IDPS, Honeypots. Tools: Auditing tools, Pocket PChacking, wireless hack walk through

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, Pearson Publications, 6th edition,20l4.
2. M. E. Whitman and Herbert J. Mattered, Principles of Information Security, Information Security Professional, 4thedition, 20l4.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill, 2007.
2. Joseph Migga Kizza, Guide to Computer Security, Springer Science & Media Inc., 3rd edition,20l5

JOURNALS/MAGAZINES:

1. Springer Journal of Cryptographic Engineering, ISSN2l90-8508 https://www.springer.com/journal/13389
2. ACM- International Journal of Applied Cryptography, ISSN:753-0563 https://dl.acm.org/citation.cfm?id=J1105
3. IEEE Transactions on Information Forensics and Security, https://ieeexplore.iee-e.org/xpl/aboutJournal.jsp?punumber=10206
4. Elsevier, Journal of Information Security and Applications, https://www.journals.elsevier.com/journal-of-information-security-and-applications

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/learn/crypto
2. https://nptel.ac.in/courses/106/105/106105031/

Course Title	Computer Vision and Applications (PE-III)				Course Type		Theory	
Course Code	B22EAS601.	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE(S):

The objectives of this course are to:

1.Explain the fundamentals of Computer vision.

2. Discuss various segmentation techniques and their applications.

3. Demonstrate the use of techniques for registration and classification of images.

4. Describe the object detection and recognition process in a given application

COURSEOUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Utilize linear filters to enhance the quality of images in given real world application.	1 to 5	1
CO2	Apply segmentation techniques to solve real world problems.	1 to 5	2
CO3	Develop image transformation techniques for solving real world problems.	1 to 5	3
CO4	Make use of object detection and recognition techniques to computer vision applications	1 to 5	3
CO5	Illustrate different filtering technique for Image Restoration and Reconstruction.	1 to 5	1
CO6	Apply watermarking and image compression techniques in computer vision applications.	1 to 5	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

COURSE CONTENT

Theory

Contents
UNIT-1
Introduction: What is Digital Image Processing?, The Origins of Digital Image Processing, Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Image Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing
UNIT-2
Intensity Transformations and Spatial Filtering: Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters **Filtering in the Frequency Domain:** Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters.
UNIT-3
Image Restoration and Reconstruction: Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.
UNIT-4
Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Wavelets and Multiresolution Processing: Wavelet and Other Image Transforms: Preliminaries, Haar Transform, Multiresolution **Morphological Image Processing:** Basic Concepts, Dilation and Erosion, Opening and Closing, Hit or miss transformation, sample applications

TEXT BOOKS:

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

REFERENCE BOOKS:

1. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach" , 2nd Edition, University of Illinois at Urbana-Champaign Jean Ponce, EcoleNormaleSuperieure, Paris©2012, Pearson
2. Richard Szeliski, " Computer Vision: Algorithms and Applications" , Springer
3. David Marr, Tomaso A. Poggio, Shimon Ullman "A Computational Investigation into the Human Representation and Processing of Visual Information", , eBook - Amazon.com.

JOURNALS/MAGAZINES:

1. International Journal of Computer Vision, Springer, https://www.springer.com/journal/11263
2. Image and Vision Computing, Elsevier, https://www.journals.elsevier.com/image-and-vision-computing
3. Computer Vision and Image Understanding, Elsevier, https://www.journals.elsevier.com/computer-vision-and-image-understanding
4. IEEE Transactions on Image Processing, https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=83

5. IEEE Transactions on Pattern recognition and machine intelligence, https://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=34

SWAYAM/NPTEL/MOOCs:

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

SELF-LEARNINGEXERCISES:

Artificial Neural Networks, Convolution Neural Network.
Implementation of applications using the above topics.

Course Title	C# and .NET (PE-III)				Course Type		Theory	
Course Code	B22EJS602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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

COURSE OBJECTIVE (S):

The objectives of 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 (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the basic components of the .NET Framework.	1 to 5	1
CO2	Develop a program using C# data types for real world applications.	1 to 5	2, 3
CO3	Make use of various interface techniques to invoke interface Members at the object Level	1 to 5	3, 1
CO4	Apply exception handling mechanisms of C# for real world applications.	1 to 5	2, 3
CO5	Analysis the new concepts and applied for applications		
CO6	Create a new application		

BLOOM'S LEVELOF THECOURSE OUTCOMES:

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

COURSE ARTICULATIONMATRIX:

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

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

COURSE CONTENT
THEORY

Contents
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.

TEXT BOOKS:

1. Andrew Trosele," Pro C# with .NET 3.0", Seventh Edition, 2007.
2. E Balaguruswamy," Programming in C#", 5th reprint, Tata McGraw Hill 2004.

REFERENCE BOOK

1. Vijay Nicoel, "Visual C#.NET", 5th reprint, Tata McGraw Hill 2004.
2. Janice Friedman, "Take Your Coding Skill Set to the Next Level, C Sharp Station", 2019

JOURNALS/MAGAZINE:

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

SWAYAM/NPTEL/MOOCS:

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

SELF LEARNING EXERCISES:

Basics of Garbage Collection, Finalization a Type, the Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, the System. GC Type.

Course Title	Software Testing (PE-III)				Course Type		Theory	
Course Code	B22EJS603	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course examines fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test case generation, test coverage, regression testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization

COURSE OBJECTIVE (S):

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):

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the fundamental concepts in software testing.	1 to5,9,10	1
CO2	Analyze the performance of testing methods on the given real world applications.	1 to5	1
CO3	Develop an application using Software Testing IDE.	1to5,10,12	2,3
CO4	Make use of locators in developing real world applications.	1 to5	1
CO5	Develop Big Data Solutions using Hadoop Eco System	1 to5,9,12	1
CO6	Analyze Info sphere Big Insights Big Data Recommendations	1 to5,9,12	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX:

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

-

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

COURSE CONTENT

THEORY

Contents
UNIT-1
Introduction: Software Testing Principles Need for testing, Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing, **Examples:** Generalized pseudocode, The triangle problem, The NextDate function, The commission problem. Introduction to Automated testing tools (open source and commercial)
UNIT-2
FunctionalTesting: Boundary value analysis, Robustness testing, Equivalence Class Testing, Decision table method, **Examples:** The triangleproblem, **Structural Testing:** Path Testing: DD-Paths, Test Coverage Metrics, Basis path Testing; Dataflow Testing: define/Use Testing, Slice Based Testing
UNIT-3
Getting Started with Selenium IDE: Important preliminary points, What is Selenium IDE, installing Selenium IDE, Selenium IDE, Rules for automation, Recording your first test with Selenium IDE Updating a test to assert items are on the page, updating a test to verify items on the page adding Selenium IDE comments, Multiplying windows, Working with multiple windows.
UNIT-4
Locators: Locating elements by ID, Finding IDs of elements on the page with Fire bug, finding elements by ID, moving elements on the page, finding elements by name, Adding filters to the name, finding elements by link text. Overview of Selenium Web Driver, History of Selenium Architecture, Web Driver API, Web DriverSPI.

TEXT BOOKS:

1. P.C. Jorgensen, "Software Testing aCraftman's Approach", CRC Press, Auerbach Publications2013.
2. David Burns, Selenium 2 Testing Tools Beginner's Guide.

REFERENCE BOOKS:

1. Glenford J. Myers, "The Art of Software Testing", John Wiley & Sons 1979
2. Boris Beizer, "Black-Box Testing: Techniques for Functional Testing of Software and Systems", John Wiley & Sons 1995.
3. William E. Perry," Effective Methods for Software Testing (2nd Edition)", JohnWiley& Sons 2000

JOURNALS/MAGAZINES:

1 Journal of Software Engineering and Research Engineering, 2013.
2 International Journal of Software Engineering, Technology and Applications, 2013.

SWAYAM/NPTEL/MOOCS:

1. https://www.nptel.ac.in/courses/106/101/106101163
2. https://www.coursera.org/courses?query=software testing

SELF-LEARNING EXERCISES:

Automated Testing tools: QTP tools, Lab View etc, ATLM.

Course Title	Natural Language Processing in AI (PE-IV)				Course Type		Theory	
Course Code	B22EAS604	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: The intent of the course is to give introduction to Natural Language Processing (NLP, a.k.a. computational linguistics), the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks as listed in the course syllabus, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical algorithms to acquire the knowledge needed to perform language processing.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of natural language processing and python
2. Discuss how to access the text corpora and Lexical Resources
3. Demonstrate the writing the structured programs to process the raw text
4. Describe role of Classifiers in Text processing

COURSEOUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concepts of python to implement NLTK Tools to solve the given real wold problems	1 to 5, 6-10	1,3
CO2	Develop an algorithm to access the text corpora and Lexical Resources to process the Raw Text	1 to 5,7-12	2
CO3	Make use of Categorizing and Tagging concepts to solve the given real world problem.	1 to 5,6-11	2,3
CO4	Analyze the performance of different classifiers in Text processing and Modelling Linguistic Patterns	1 to 5,7-10	1
CO5	Apply text processing and modelling Linguistic Patterns	1-12	3
CO6	Develop an algorithm for solving real world problems	1-12	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	3	2	3	0	0	3	0	3
CO2	2	3	2	3	3	0	3	2	2	3	2	3	0	3	0
CO3	2	3	2	3	2	3	2	3	2	3	2	0	0	3	2
CO4	3	3	1	3	2	0	3	2	3	2	0	0	3	0	0
CO5	3	2	3	2	3	2	3	2	3	2	3	2	0	0	3
CO6	2	3	2	3	3	3	2	3	2	3	2	3	0	0	3

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

COURSE CONTENT
THEORY:

Contents
UNIT-1
Language Processing and python, Accessing Text corpora and Lexical Analysis: Computing with language: Texts and words, a closer look at python: texts as list of words. **Computing with language**: simple statistics, Automatic natural language understanding; Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet, Introduction to NLTK Tool.
UNIT-2
Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode,Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation,

Formatting: From Lists to Strings.
UNIT-3
Categorizing and Tagging Words: Using a Tagger, Using a Tagger, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word.
UNIT-4
Classifying Text: Supervised Classification: Examples, Evaluation; Decision Trees, Naive Bayes Classifiers, Maximum Entropy Classifiers, Modelling Linguistic Patterns.

Text books:

1. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python", First Edition, OReilly Media, 2009.
2. Yuxi (Hayden) Liu, "Python Machine Learning by Example", First edition, Packt publisher, 2017.

Reference books:

1. James Allen," Natural Language Understanding", Benjamin-Cummings Publishing Co., Inc. Redwood City, CA, USA,1995.
2. Christopher D. Manning and Hinrich Schutze," Foundations of Statistical Natural Language Processing", The MIT Press, 1999.
3. Randolf Quirk, Sidney Greenbaum, Geoffrey Leech, Jan Svartvik, "A Comprehensive Grammar of English Language", Cambridge University Press,1987.

JOURNALS/MAGAZINES:

1. https://dl.acm.org/journal/tslp
2. https://www.journals.elsevier.com/cognitive-systems-research

SWAYAM/NPTEL/MOOCs:

1.https://nptel.ac.in/courses/106/105/106105158/
2.https://www.mooc-list.com/tags/nlp

SELF-LEARNINGEXERCISES:

Extracting information from Text, Exploring the 20 Newsgroups with Text Analysis Algorithms, Stock Price prediction with Regression Algorithms, Best Practices: i) Data preparation stage ii)Training sets generation stage iii) Model training, evaluation and selection stage.

Course Title	Deep Learning (PE - IV)				Course Type		Theory	
Course Code	B22EJS605	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

OVERVIEW:

Neural Networks are an effective programming paradigm that enable a computer to learn from observed data. They simulate biological learning of the nervous system and have been demonstrated to increase the power of known machine learning models by stacking them as computational graphs. This is different from conventional programming where human programmers define the set of tasks to be carried out by a computer to solve a problem. Deep learning is a subset of machine learning that uses many layers of neural networks to accomplish tasks like image recognition, text procession, speech recognition, natural language processing etc. This course aims at giving the students the knowledge and the skills required to model the solutions to real world problems using neural networks and deep learning.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the fundamentals of neural network based paradigm to problem solving.
2. Inculcate knowledge of concepts involved in training of convolutional neural networks.
3. Discuss the concepts and issues in recurrent neural networks.
4. Introduce prominent Generative Adversial Networks and unsupervised learning paradigms.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental architecture of neural network and the concepts involved.	1,2,3,4,5	1,2
CO2	Apply the shallow neural network models - Perceptron, Least-Squares Regression, Logistic Regression, Support Vector machines to solve real world binary and multiclass classification problems.	1,2,3,4,5	1,2
CO3	Develop simple deep neural networks to solve problems in unsupervised learning.	1,2,3,4,5	1,3
CO4	Create deep neural models like CNN and RNN to solve problems.	1,2,3,4,5	1,3
CO5	Illustrate the applications of CNN, RNN and GAN for solving real world Problems	1,2,3, 11, 12	1,3
CO6	Develop solutions using neural network based algorithms for the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3, 11, 12	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Course Content:
Theory:

Contents
UNIT-1

Introduction to Deep Learning
Feed Forward Neural Network, Difference between feed forward neural network and deep neural network, Activation Functions and Loss functions, Batch normalization, Regularization and Optimization. Linear Regression, Gradient Descent, Fine-Tuning Hyper parameters. Case study: Simple Neural Networks' Implementation using keras

Unit 2

Convolutional Neural Network(CNN), Transfer Learning
Architecture of CNNs, Filters, FeatureMaps, Max-Pool Layers, Other Pooling Types, Back Propogation, Convolution Architectures - Alexnet, ZFNet, VGGNet, GoogleNet, ResNet, Transfer Learning, Case Study: Image Recognition Using CNN.

Unit 3

Recurrent Neural Networks (RNN)
Introduction-Recurrent Neurons, Memory Cells, Variable-Length Input-Output Sequences, RNN Architecture, Sequence learning problem, Back Propagation Through Time, Vanishing and Exploding Gradient, Bidirectional RNN, LSTM Cell and Gated Recurrent Unit (GRU) Cell, Text Classification with RNN, Encoder/Decoder architecture, Seq2Seq

model with Attention Transformer model and BERT model , Transformer Attention and Case study: RNN model implementation

Unit 4

GAN, Unsupervised Feature Learning, GNN

GAN - Architecture and Training Methods, Image-Generation, Hands-On Implementation Using Keras, DCGAN with keras, Unsupervised Feature Learning – Autoencoders , Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders and Variational Auto Encoders, GNN – Graphical Neural Networks, Graph Convolutional Networks, Applications of GNN.

TEXTBOOKS:

1. Charu Aggarwal, "Neural Networks and Deep Learning", Springer, 2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press

REFERENCEBOOKS:

1. Francis Chollet, "Deep Learning with Python", Manning, 2018.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishing Company, 1995.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Macmillan College Publishing Company, 1994.
4. Mohamad H. Hassoun, Fundamentals of Artificial Neural Networks, The MIT Press, 1995.
5. Laurene Fausett, Fundamentals of Neural Networks: Architectures, Algorithms, and Applications, Prentice HallInternational, Inc., 1994.
6. B. D. Ripley, Pattern Recognition and Neural Networks, Cambridge University Press. 1996.

JOURNALS/MAGAZINES

1. IEEE Transactions on Neural Networks and Learning Systems https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385
2. IEEE Transactions on Pattern Analysis and Machine Intelligence https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf
3. International Journal of Intelligent Systems https://onlinelibrary.wiley.com/journal/1098111x
4. http://www.charuaggarwal.net/neural.htm
5. http://neuralnetworksanddeeplearning.com/
6. https://github.com/mnielsen/neural-networks-and-deep-learning
7. deeplearning.stanford.edu
8. http://yann.lecun.com/exdb/mnist/
9. University of California Irvine Machine Learning Repository - https://archive.ics.uci.edu/ml/datasets.php

SWAYAM/NPTEL/MOOCs:

1. Swayam Nptel – Deep Learning – IIT Ropar https://onlinecourses.nptel.ac.in/noc21_cs35/preview
2. Coursera – Neural Networks and Deep Learning Andrew Ng
3. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

Course Title	Compiler Design (PE-IV)				Course Type		Theory	
Course Code	B22EJS606	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Course Description: The Course intends to make students learn the techniques needed for compiler construction and develops analytical skills. The course is conceptual.

COURSE OBJECTIVE (S):

1. Explain the concepts of Object-Oriented programming, Object-Relational Databases and Compilers.
2. Describe how syntax tree can be constructed to check the syntax of the given input.
3. Discuss different types of parsers and syntax directed definition and translation.
4. Demonstrate how code optimization and code generation is done for a given source code.

COURSEOUTCOMES (COs)

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

CO#	Course Outcomes	Pos	PSOs
CO1	Apply the concepts of lexical, syntactic and semantic analysis to parse the given statement.	1-5,8-10	1
CO2	Experiment with the knowledge of different parsers by constructing the top down and SLR parsers.	1-5,7,8,10-1	2
CO3	Make use of different types of parsers and syntax directed definition and translation to check the syntax of the given input.	1-5,8,9,11,1	1
CO4	Develop code optimization and code generation for a given source code.	1-5 ,11,12	2,3
CO5	Apply some algorithms for real time environment	1-12	3
CO6	Develop new algorithms for real world environment	1-12	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	0	0	3	2	3	2	2	3	0	0
CO2	2	2	2	1	1	0	2	3	0	3	2	2	0	3	0
CO3	2	2	2	1	1	0	0	3	2	0	1	2	3	0	0
CO4	2	2	2	1	1	0	0	0	0	0	2	2	0	3	3
CO5	3	2	3	2	3	3	2	3	2	3	2	3	0	0	3
CO6	2	3	2	1	2	3	2	3	2	3	2	3	0	0	3

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

COURSE CONTENT

THEORY:

Contents
UNIT-1
Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Introduction to Compilers: Language processors; the structure of a Compiler. **Lexical analysis:** Tokens, Regular expressions, Finite state automata, translating regular expressions into finite state automata;
UNIT-2
Syntax analysis 1: Context-free grammars, Derivations and syntax trees, Handling ambiguous grammars, Top-down parsing, Bottom-up parsing – SLR ();
UNIT-3
Syntax Analysis 2: More powerful LR Parsers. **Syntax-directed translation:** Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Parser stack implementation of Postfix SDT;
UNIT-4
Code optimization and generation: Basic blocks and Flow graphs; Optimization of basic blocks. **Intermediate code generation:** Variants of syntax trees; Three-address code; Control flow; back patching;

TEXT BOOKS:

1. A. V. Aho, R. Sethi and J. D. Ullman, Compilers – Principles, Techniques, and Tools, Addison-Wesley, Pearson Education, 2001.
2. Charles N. Fischer, Richard J. LeBlanc, Jr., Crafting a Compiler with C, Pearson Education, 1991.
3. Kenneth C Louden, Compiler Construction Principles & Practice, Cengage Learning, 1997.

REFERENCE BOOKS:

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

JOURNALS/MAGAZINES

1. https://www.springer.com/gp/book/9783319669656
2. https://ieeexplore.ieee.org/document/101813
3. IEEE, IEEE Transactions on Computers.
4. Elsevier, Computer Languages, Systems and Structures.
5. Springer, Journal of Logic, Language and Information.
6. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/104/106104123/
2. https://www.mooc-list.com/tags/compilers

SELF-LEARNINGEXERCISES:

More Recent Applications: translating regular expressions into finite state automata; survey of latest compilers for dealing with parallel programming.

Course Title	BIG DATA ANALYTICS LAB				Course Type		Practical	
Course Code	B22EJ0602	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including Hadoop and Spark.

COURSE OBJECTIVE (COs):

The objectives of this course are to:

1. Explain the concepts of Big Data and its Business Implications.
2. Describe the framework for Scala and Spark for Big-Data Analytics.
3. Discuss the use of features of Apache Spark for Data Analytics.
4. Demonstrate solving of Business Problems with Machine Learning in Spark and Scala.

COURSE OUTCOMES(COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Big Data in real world applications.	1 to 5,9,12	1,2,3
CO2	Apply the theories of Hadoop in Scala for Big Data Analytics.	1 to 5,9,12	1,2,3
CO3	Design a Data Analytics Framework using Apache Spark with Scala.	1 to 5,9,12	1,2,3
CO4	Develop a real world application using Apache Spark with Scala.	1 to 5,9,12	1,2,3
CO5	Learn new tools and technologies in the Big Data Analytics and apply for suitable application development.	12	1,2
CO6	Develop solutions in the Big Data Analytics to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Lab programs

1. Installation and Configuration of Hadoop.
2. Evaluate the performance of MapReduce program on word count for different file size.
3. Evaluate the performance of MapReduce program on Character count for different file size.
4. Using MapReduce process the weather dataset.
5. Evaluate performance of PIG Latin script for student data.

TEXT BOOKS:

1. Sridhar Alla, "Big Data Analytics with Hadoop 3", Packt Publishing Ltd, May 2018
2. Subhashini Chellappan, Dharanitharan Ganesan, "Practical Apache Spark Using the Scala API", A Press, 2018.

REFERENCE BOOKS:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj, “Big data, big analytics”, Wiley,2013
2. P. Tan, M. Steinbach, V. Kumar, “Introduction to Data Mining”, Addison-Wesley, 2005.
3. J. Han, M. Kamber, “Data Mining: Concepts and Techniques”, 2nd ed. Morgan Kaufmann2005.

JOURNALS/MAGAZINES

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6687317
2. https://www.journals.elsevier.com/big-data-research
3. https://journalofbigdata.springeropen.com
4. https://dl.acm.org/journal/jmlr

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://www.edx.org/course/big-data-and-education

SELF-LEARNING EXERCISES:

Spark Real-Time Use Case: Data Analytics Project Architecture, Data Ingestion, Data Storage, Data Processing, Data Visualization

Course Title	CLOUD COMPUTING LAB				Course Type		Theory	
Course Code	B22CI0603	Credits	4		Class		VI semester	
Course Struct-ure	TLP	Credits	Contact Hours	Work Load	14 weeks / Semeste		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

The *course* presents a top-down view of *cloud computing*, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for *cloud computing* and large scale distributed systems which form the *cloud* infrastructure.

COURSE OBJECTIVE

1. Introduce cloud computing and provide knowledge in different layers of cloud computing such as: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
2. Describe various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology
3. Explain Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization.
4. Provide knowledge about cloud security and threats

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the cloud computing concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)	1-5	2
CO2	Use various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology	1-5	3
CO3	Apply Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization in developing cloud applications.	1-5,10	1,3
CO4	Analyze cloud security and threats for new problems in hand and develop and p-rovide security services for cloud based applications	1-5, 10,11	2,3
CO5	Learn new tools and technologies in Virtualization and cloud computing concepts and apply for suitable solutions for application development.	12	2,3
CO6	Develop solutions in Virtualization and cloud computing concepts to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

PRACTICE

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Evaluate the performance of MapReduce program on word count for different file size.	Ubuntu Linux 10.04 LTS (deprecated: 8.10 LTS, 8.04, 7.10, 7.04) Hadoop 1.0.3 Hadoop requires a working Java 1.5+ (aka Java 5) installation. However, using Java 1.6 (aka Java 6) is recommended for running Hadoop	To perform the performance of MapReduce program

2.	Design a document, excel sheet, presentation and form using Google Docs, Google sheets, Google Slides and Google Forms. a) Create your resume using Google Docs and send it to your teacher and get it reviewed by your teacher. b) Create a spreadsheet containing cab requirements and collect the details from various guest teachers. c) Create a presentation containing phase1 details of your project in collaboration with your project team members.	Browser Google Account	To design a resume in different forms.
3.	Create multiple VM's on a single physical machine. Provide a communication between them using and without using Client.	To install and setup the Virtual Machine To check the connectivity between the Virtual Machines	To create multiple virtual machines
4.	Demonstrate the communication of VM's on different physical devices using ESXI.	To install and setup the Virtual Machine on same and different ESXi. To check the connectivity between	communicate VM's on ferent ysical devices
5.	Illustrate the cloning of VM's.	To configure and maintain the VM's. To configure a multiple Virtual Machines on multiple ESXi's.	To create a duplicate of the virtual machine with the same configuration
6.	Illustrate the backup-restore scenario. -	To figure out the different ways of backup and restore the sessions of Virtual Machine.	The VM, to which the backup is required should be in ON
7.	Add iSCSI adapter and modify the relative parameters. Create a new VMkernel using iSCSI port binding.	To provide the adapter for the already created VM's	To create a new VM kernel
8.	Performance Analysis of Virtual Machine vs Physical Machine.	To find the performance of VM's in ESXi	To Perform analysis of Virtual Machine vs Physical Machine
9.	Design a module to control an LED from Webserver using NodeMcu or Esp8266 programming with Arduino IDE.	Create IOT application using Cloud.	To control an LED from Cloud Service.
10.	Create a data center using vCenter for multiple VM's.	To install and configure the vCenter server Create a final data center for different VM's	To perform and create a data center.

11.	Install and configure the vSphere Web client	To install and configure the vSphere web Client to access the vCenter server. Create a final data center for different VM's	To perform and install and configurations
12.	Illustration of vMotion to move the VM's from one ESXi to another ESXi -	To install and configure the vSphere web Client to access the vCenter server Create a final data center for different VM's. Identify the way of moving the VM's from one ESXi to another. Migrate the VM's from one to another ESXi.	To migrate running virtual machines from one physical server to another.

	Mini Project Green Cloud Computing: Demand Allocation and Pricing Policies for Cloud Service Brokerage		
1	Functioning as an intermediary between tenants and cloud providers, cloud service brokerages (CSBs) can bring about great benefits to the cloud market. As energy costs of cloud computing have been increasing r-apidly, there is a need for cloud providers to optimize energy efficiency while maintain high service level performance to tenants, not only for their own benefit but also for social welfares. Thus, for green cloud companies, two questions have arisen: 1) under what pricing policies from the cloud providers to the CSB, a profit-driven CSB is willing to minimize the total energy cost while satisfy tenant demands and 2) how should a CSB distribute tenants demands to achieve this objective? To address question 1), we find a pricing policy for cloud providers such that maximizing CSBs profit is equivalent to minimizing cloud providers energy cost. To address question 2), we first devise a greedy solution, and then propose an approximation algorithm and a decomposition-based solution with a constant approximation ratio. Both simulation and real-world Amazon EC2 experimental results demonstrate the effectiveness of our pricing policy to incentivize CSBs to save energy and the superior performance of our algorithms in energy efficiency and resource utilization over the previous algorithms.	Cloudsim Tools for Cloud, Edge and Fog Computing	To multiple cloud providers to minimize the energy cost of cloud provider
2.	**Enhancing Performance And Energy Efficiency For Hybrid Workloads In Virtualized Cloud Environment** Virtualization has accomplished standard status in big business IT industry. In spite of it's across the board appropriation, it is realized that virtualization likewise presents non-paltry overhead when executing undertakings on a virtual machine (VM). Specifically, a consolidated impact from gadget virtualization overhead and CPU booking dormancy can cause execution corruption when calculation concentrated undertakings and I/O serious errands are co-situated on a VM. Such an impedance causes additional vitality utilization, too. In this paper, we display Hylics, a novel arrangement that empowers proficient information cross ways for both I/O and calculation serious workloads. This is accomplished with the arrangement of in-memory record framework and system benefit at the hypervisor level. A few vital plan issues are pinpointed and tended to amid our model execution, including proficient moderate information sharing, organize benefit offloading, and QoS-mindful memory use administration. In view of our genuine -organization on KVM, Hylics can essentially enhance calculation and I/O execution for mixture workloads. In addition, this pl-an likewise mitigates the current virtualization overhead and normally improves the general vitality effectiveness.	atform virtualization, Load management, Network interfaces, VM monitors	To enhance performance and energy efficiency

TEXT BOOKS:

3. Thomas Erl , Ricardo Puttini , Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI, 2013.
4. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra, Distributed and Cloud Computing, MK, 2012.

REFERENCE BOOKS:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, MK
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms,Wiley.
4. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing, A practical approach, TATA -McGRAW HILL.
5. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications, CAMBRIDGE.
6. David Marshall, Wade A. Reynolds and Dave McCrory, Advanced Server Virtualization-VMware and Microsoft Platforms in the Virtual Data Center, AUERBACH Publications.

JOURNALS/MAGAZINES:

4. International Journal of Cloud Computing, INDERSCIENCE Publishers.
5. IEEE Cloud Computing
6. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

SWAYAM/NPTEL/MOOCS:

4. https://onlinecourses.nptel.ac.in/noc21_cs15/preview
5. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
6. https://www.classcentral.com/course/swayam-cloud-computing-and-distributed-systems-17544

SELF LEARNING EXERCISES:

4. https://www.cybrary.it/course/virtualization-management/
5. http://cds.iisc.ac.in/faculty/simmhan/SE252/
6. https://data-flair.training/blogs/hardware-virtualization-in-cloud-computing/

Course Title	Information and Network Security Lab				Course Type		Theory	
Course Code	B22CI0604	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	50%	50%

COURSE OVERVIEW:

Course Description: The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices i Intrusion Detection Systems	1 to 5	1
CO2	Make use of the different cryptographic algorithms for encryptio and decryption of given data.	1 to 5	2
CO3	Compare the various performance of protocols used fo authentication.	1 to 5	2,3
CO4	Identify security in different layers of OSI for solving real world network problems	1 to 5	1
CO5	Relate different firewalls available for more security	1 to 5	2,3
CO6	Identify different auditing tools for intrusion management system.	1 to 5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

Practice:

Prerequisites: Computer Networks, C/C++/Java/python

List of Experiments

1. Study the tool used for Network scanning ie NMAP and conduct the network analysis.
2. Setup a honey pot and monitor the honeypot on network (KF Sensor).
3. Implement Caesar cipher using suitable programming and show the successful decryption of Ciphertext and verify the same with “Cryptool”.
4. Implement DES algorithm to encrypt the data and verify the same with ‘Cyptool’.
5. Implement a simple RSA algorithm and demonstrate how to recover the Plaintext.
6. Demonstrate how to perform key exchange securely using Diffie Helman Keyexchange mechanism.
7. Demonstrate the data hiding using any steganography tools.
8. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
9. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool.
10. Install the Tinywall and configure it. Inspect the incoming and outgoing packets. Prepare the report of the Firewall traffic analysis.

Course Title	Mini Project - Research Based				Course Type		Theory	
Course Code	B22CI0605	Credits	2		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	2	4	4	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**4**	**4**	**0**	**52**	**-**	**100%**

COURSE OVERVIEW:

This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. This course introduces problem selection, synopsis writing, ethics, research design skills, research methods, how to carry out literature survey, reading and writing technical paper, thesis writing, introduction atex and beamer and how to design the quality research proposal.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the dimensions and methods of research.
2. Illustrate the design of informed choice from the large number of alternative methods and experimental designs available.
3. Describe the features of a good research proposal.
4. Discuss the skills required for undertaking a research project and preparing a technical paper

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the dimensions and methods of research for solving real world problems.	1,4,7,11,12	2,3
CO2	Identify the appropriate research problem and parameters to carry out the research work.	2,5,6,12	2,3
CO3	Apply different research skills in preparing proposal for research projec and technical paper.	6,7,11	2,3
CO4	Create IPR documents using Latex Tool.	3,12	3
Co5	Describe the features of a good research proposal	2,5,6,12	2,3
Co6	Illustrate the design of informed choice from the large number of alternative methods and experimental designs available	6,7,11	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√	√	
CO3			√			
CO4						√
Co5		√				
Co6			√			

COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			2			1				1	1	1	2	
CO2		2			1	3						2	2	2	
CO3						2	1				2		2	1	
CO4			2									2			3
Co5		2			1	3						2	2	2	
Co6						2	1				2		2	1	

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

A Mini Project has to be carried out by the students and the same has to be completed by the end of semester. Students have to spend a minimum of 8 hours per week on the mini project. A Mini Project has to be developed and documented using Latex. The outcome of the mini project should be paper publication/ IPR.

Semester – 7

Course Title	MULTIMEDIA SYSTEMS (PE-V)				Course Type		Theory	
Course Code	B22EJS701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

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:

- Gain fundamental knowledge in understanding the basics of different multimedia networks and constraint's for a good Quality of service in multimedia environment.
- Demonstrate the process management and multimedia buffer management technique.
- Explain the Network Services and Protocols for Multimedia Communications
- Gain fundamental knowledge about multimedia communication across different networks.

COURSE OUTCOMES:

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the multimedia Components required for developing real world applications	1 to 4, 9, 12	1
CO2	Choose a suitable Lossy and Lossless compression techniques for compressing the given multimedia data.	1 to 3,5,9,1	2
CO3	Design the applications using different compression techniques for Image and video	1 to 3,5,9, 1	3
CO4	Analyse the working of synchronization in multimedia data.	1 to 5, 9, 12	2,3
CO5	Apply Multimedia to wireless networking environments	1 to 5, 7,9,10,	3
CO6	Develop an algorithm to multimedia technologies	1 to 6, 8,9,10,	3

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	0	0	0	0	2	0	0	2	3	0	0
CO2	3	2	2	0	2	0	0	0	1	0	0	1	0	3	0
CO3	3	1	1	0	2	0	0	0	1	0	0	1	0	0	3
CO4	3	2	2	2	2	0	0	0	2	0	0	2	0	3	3
CO5	2	3	2	3	1	0	3	0	2	3	3	2	0	0	3
CO6	3	3	2	3	2	3	0	2	3	3	0	2	0	0	3

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

COURSE CONTENT:

Theory

UNIT - 1
Introduction - Interdisciplinary Aspects of Multimedia, Quality of Service, Multimedia Operating Systems, Multimedia Networking and Communication, Synchronization. Quality of Service - Requirements and Constraint, Quality of Service Concepts, Resources, Establishment Phase, Run-time Phase of Multimedia Call, QoS Management Architectures.
UNIT - 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.

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.

JOURNALS/MAGAZINES:

2. IEEE, IEEE Transactions on Multimedia.
3. ACM, ACM Transactions on Multimedia Computing, Communications, and Applications
4. Elsevier, Elsevier Journal on Multimedia Computing. Springer, Springer Journals on Communication Networks

SWAYAM/NPTEL/MOOCs:

1. https://www.mooc-list.com/tags/multimedia
2. https://nptel.ac.in/courses/117/105/117105083/

SELF LEARNING:

Social Media Sharing- Representative Social Media Services, User-Generated Media Content Sharing, Media Propagation in Online Social Networks.

Course Title	Augmented and Virtual Reality (PE-V)				Course Type		Theory	
Course Code	B22EJS702	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course covers basic concepts of augmented reality and virtual reality. The course also introduces the student to the working of multiple models of input and output interface in VR. The course also helps the student to understand development tools and frameworks in VR. Further, this course helps the student to work on the application of VR in digital entertainment.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the principles and multidisciplinary features of Virtual Reality.
2. Illustrate the multimodal user interaction and perception in Virtual Reality.
3. Demonstrate the use of objects for managing large scale Virtual Reality environment in real time.
4. Discuss the various solutions using Virtual Reality system framework and development tools for industry and social relevant applications.

COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the components of Augmented Reality and Virtual Reality.	1-5,7,9 ,10,11	1
CO2	Apply multimodal user interaction and perception techniques involved in Virtual Reality.	1-5,8,9,10,1	3
CO3	Develop real world applications using simulation and interactive techniques.	1-5,8,9, 10,11,12	2,3
CO4	Choose the innovative Virtual Reality solutions for industrial and Social relevant applications.	1-6, 8-12	1
CO5	Evaluate current trends of AR and VR media delivery to propose options to potential clients, and discuss the benefits, challenges and misconceptions involved with working in AR and VR.	1-12	1,2
CO6	Evaluate various interaction schemes common to AR/VR experiences.	1-12	2

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	0	3	0	2	3	3	0	3	0	0
CO2	3	3	3	2	3	0	0	3	3	3	3	2	0	0	3
CO3	3	3	3	2	2	0	0	3	2	3	3	2	0	3	3
CO4	3	3	2	3	2	0	0	3	2	3	3	2	3	0	0
CO5	2	2	3	2	3	2	2	3	2	3	2	3	2	1	0
CO6	3	2	3	3	3	2	3	2	3	3	2	3	1	2	0

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

COURSE CONTENT

THEORY:

Contents
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, Behavior 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, Unity. **Application of VR in Digital Entertainment:** VR Technology in Film and TV Production, VR Technology in Physical Exercises and Games, Demonstration of Digital Entertainment by VR.

TEXT BOOKS:

1. Dieter Schmaltzier and Tobias Hollerer. Augmented Reality: Principles and Practice, Addison-Wesley, 2006.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

REFERENCE BOOKS:

1. Sherman, William R. and Alan B. Craig, Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
2. Fei GAO, Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
3. Guangran LIU, Virtual Reality Technology, Tsinghua Press, Jan. 2011.

JOURNALS/MAGAZINES:

1 International Journal of Virtual and Augmented Reality (IJVAR), https://www.igi-global.com/journal/international-journal-virtual-augmented-reality/145080

2. Springer, Virtual Reality, https://www.springer.com/journal/10055

SWAYAM/NPTEL/MOOCs:

1. https://www.mooc-list.com/tags/virtual-reality

Course Title	Full Stack Development (PE-IV)				Course Type		Theory	
Course Code	B22EJS703	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Full stack Developer covers concepts of the method of applying both front-end and back development protocols to develop websites. This course introduces the student to develop his own project or application. It also helps the student to understand the basics in CSS, JavaScript's, NODEjs, and MongoDB.

COURSE OBJECTIVE (S):

1. Introduction to basic concepts of Full Stack Web Development.
2. Explain the fundamentals of HTML, CSS, Bootstrap and its applications.
3. Introduction to Javascript & ReactJS.
4. Develop a new application using the front-end stack.
5. Learn new tools and technologies in full stack development and apply for suitable application development.
6. Develop solutions in full stack to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the platform needed for full stack web development	1,2,3,9,12	3
CO2	Understand the Markup, CSS & BootStrap	1-5,9	3
CO3	Use the JavaScript to design a Web Application.	1-5,9,11	3
CO4	Understand the ReactJS Concepts.	1-5,9,11	3
CO5	Deploy the developed web application in real time scenarios.	1-5,9,12	2
CO6	Developer of the industrial software.	1-5,9,12	2

BLOOM'S LEVELOF THECOURSE OUTCOMES:

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2						3			2	3	3	2
CO2	3	3	3	2	2				3						
CO3	3	3	3	2	3				3						
CO4	2	2	3	2	2				3						
CO5	3	3	3	1	3				2			3			
CO6	2	2	3	3	3				2			3			

Contents
UNIT-1
Full Stack Web Developer Introduction to Full Stack Web Developer, Front End Developer, Back End Developer, HTML Syntax and Semantics, CSS & Advanced CSS, Bootstrap.
UNIT-2
JavaScript JS Syntax, JS Comments, JS Variables, JS Let, JS Const, JS Operators, JS Data Types, JS Functions, JS Objects, JS Strings, JS String Methods, JS String Search, JS Array, JS Array Methods, JS Conditional Statement and JS Looping Statement.
UNIT-3
ReactJS Introduction to ReactJS, ECMAScript 6, React Render HTML, React JSX, React Components – Class Component, React Prop, React Events, React Condition, React Forms, React Hooks.
UNIT-4
Real Time Deployment Of Web Application Deploy Web Applications on server or cloud, Configuring the Server for application, Deploying database on server and Establishing connection with database, Synchronies database with deployed Application.

Text Books:

1. "Learning Web Design : A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Niederst Robbins
2. JavaScript: JavaScript For Beginners - Learn JavaScript Programming with ease in HALF THE TIME by Stephen Blumenthal
3. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux by Kirupa Chinnathambi

REFERENCE BOOKS:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-littlemongodb-book
2. W3schools - https://www.w3schools.com/REACT/default.asp.
3. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
4. https://aws.amazon.com/education/awseducate/
5. http://packaging.ubuntu.com/html/packaging-new-software.html
6. http://www.pyinstaller.org/ 6. https://pypi.org/project/py2exe/0.9.2.0/

JOURNALS/MAGAZINES:

1. https://vitamintalent.com/
2. https://www.ijert.org/the-new-era-of-full-stack-development

course Title	Internship/Global Certification				Course Type		Theory	
Course Code	B22CI0701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	3	3	3	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**-**	**42**	**-**	**100**

COURSE OVERVIEW:

This course covers student's knowledge with industry.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Learn industry knowledge
2. Get certificate of emerging technologies

Course Out comes (Cos):

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

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,810,11,12,	1
CO2	lyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	3	2	0	2	3	2	3	0	0
CO2	3	3	2	1	3	0	3	2	3	0	2	3	0	3	0
CO3	3	3	3	2	2	0	3	2	3	0	2	3	0	3	3
CO4	3	3	3	1	1	0	0	3	3	2	3	0	0	0	3
CO5	3	2	3	3	3	2	2	3	2	3	2	3	0	0	3
CO6	3	2	3	3	2	2	3	2	3	2	3	2	0	0	3

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

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2. https://www.journals.elsevier.com/
3. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms.

Course Title	Project Phase-1				Course Type		Theory	
Course Code	B22CI0702	Credits	4		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	4	6	6	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**4**	**6**	**6**	**-**	**84**	**-**	**100**

COURSE OVERVIEW:

This course covers student's innovation in current trends.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Learn current trends
2. Expose their knowledge with innovation methods to develop new technology

Course Outcomes (Cos):

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

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,810,11,12,	1
CO2	lyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	3	2	0	2	3	2	3	0	0
CO2	3	3	2	1	3	0	3	2	3	0	2	3	0	3	0
CO3	3	3	3	2	2	0	3	2	3	0	2	3	0	3	3
CO4	3	3	3	1	1	0	0	3	3	2	3	0	0	0	3
CO5	3	2	3	3	3	2	2	3	2	3	2	3	0	0	3
CO6	3	2	3	3	2	2	3	2	3	2	3	2	0	0	3

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

JOURNALS/MAGAZINES

1. https://www.springer.com/journal/500
2. https://www.journals.elsevier.com/
3. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms

Semester - 8

Course Title	Project - Phase-II				Course Type		Theory	
Course Code	B22CI0801	Credits	12		Class		VIII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	12	12	12	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	12	12	12	-	168	-	100

COURSE OVERVIEW:

This course covers student's innovation in current trends.

COURSE OBJECTIVES:

Objectives of this course are to:

1. Learn current trends
2. Expose their knowledge with innovation methods to develop new technology

Course Outcomes (Cos):

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

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5,7,810,11,12,	1
CO2	lyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	3	2	0	2	3	2	3	0	0
CO2	3	3	2	1	3	0	3	2	3	0	2	3	0	3	0
CO3	3	3	3	2	2	0	3	2	3	0	2	3	0	3	3
CO4	3	3	3	1	1	0	0	3	3	2	3	0	0	0	3
CO5	3	2	3	3	3	2	2	3	2	3	2	3	0	0	3
CO6	3	2	3	3	2	2	3	2	3	2	3	2	0	0	3

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

JOURNALS/MAGAZINES

1 https://www.springer.com/journal/500

2 https://www.journals.elsevier.com/

course Title	Internship/Global Certification				Course Type		Theory	
Course Code	B22CI0802	Credits	2		Class		VIII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	2	4	4	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**2**	**4**	**4**	**-**	**56**	**-**	**100**

COURSE OVERVIEW:

This course covers student's knowledge with industry.

COURSE OBJECTIVES:

Objectives of this course are to:

3. Learn industry knowledge
4. Get certificate of emerging technologies

Course Out comes (Cos):

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

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,810,11,12,	1
CO2	lyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	3	2	0	2	3	2	3	0	0
CO2	3	3	2	1	3	0	3	2	3	0	2	3	0	3	0
CO3	3	3	3	2	2	0	3	2	3	0	2	3	0	3	3
CO4	3	3	3	1	1	0	0	3	3	2	3	0	0	0	3
CO5	3	2	3	3	3	2	2	3	2	3	2	3	0	0	3
CO6	3	2	3	3	2	2	3	2	3	2	3	2	0	0	3

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

JOURNALS/MAGAZINES

2. https://www.springer.com/journal/500
4. https://www.journals.elsevier.com/
5. Https://IEEE.org

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105173

SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithms.