REVA UNIVERSITY
Bengaluru, India

School of Computing and Information Technology

B.Tech. CSE
(Artificial Intelligence and Machine Learning)

2022-26 Batch

HANDBOOK

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

B. Tech. in Computer Science and Engineering (AI&ML)

HANDBOOK

2022-26

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Rukmini Educational
Charitable Trust

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Chancellor's Message

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

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

It is deemed virtuous to serve seekers of knowledge 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.), 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. 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 curriculum also focusses on skill development, innovation and entrepreneurship.

This handbook presents the B.Tech in Computer Science & Engineering (AI&ML) 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 Artificial Intelligence and Machine learning. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Robotics, Data Visualization, Virtual and Augmented Reality, Speech and Video Processing and Artificial Intelligence in Healthcare. Theoretical foundations of engineering, science, and artificial intelligence and learning models 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 in Computer Science & Engineering (AI&ML) are as follows:

1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Deep Learning, Cloud Computing, Python/R Programming, Natural Language Programming (NLP), Internet of Things (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; Artificial Intelligence and Machine Learning, Data Science, Internet of Things, Network Security, Cloud Computing, Computer vision, Neural Networks, cognitive computing, block chain technology etc. State of art laboratories are available for the purpose of academics and research.

Dr. Mallikarjun Kodabagi

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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 27[th]February, 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, Counselors and Placement Officers.

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

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

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 every day 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 the School of Computing and Information Technology

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

This program contains an array of courses which are related to computation like design and analysis of algorithms, computer programming languages, software design, and computer hardware. This program also has courses related to electrical and electronics engineering, applied sciences and linguistics. Data Science is the future of Artificial Intelligence which has grown exponentially in last few years. This specialization is proposed to enable students to develop smart machines with a cutting-edge combination of AI & Data Science technologies like, Artificial Intelligence, Machine Learning, Data Science and Statistics, Big Data Analytics, Computer Vision, Business Intelligence, Deep Learning and Reinforcement learning, Robotics, Predictive Analytics using R, Swarm and Bio-inspired Intelligence, Robotic Process Automation, Genetic Algorithms, Computer Vision, Human Machine Interaction, Fuzzy Logic Systems, Natural Language Processing, etc.

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 & Engineering (AI&ML) to create motivated, innovative, creative thinking graduates to fill ICT positions across sectors who conceptualize, design, analyse, and develop AI and ML applications to meet the modern day requirements.

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

Program Educational Objectives (PEO'S)

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

- **PEO-1:** Demonstrate technical skills, competency in AI & ML and exhibit team management capability with proper communication in a job environment.

- **PEO-2:** Support the growth of economy of a country by starting enterprise with a lifelong learning attitude

- **PEO-3:** Carry out research in the advanced areas of AI & ML and address the basic needs of the society.

Program Outcomes (POs)

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

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in machine learning and Computer Science & 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 Computer Science & Engineering (AI&ML) program will be able to:

- **PSO-1:** Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems.
- **PSO-2:** Apply computational knowledge and project development skills to provide innovative solutions.
- **PSO-3:** Use tools and techniques to solve problems in AI & ML.

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 Artificial Intelligence and Data Science
		B Tech in Computer Science and Engineering (IoT,and Cybersecurity including Block chain Technology)
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 Engineer
		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. 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.

Sl. No.	Program	Duration	Eligibility
			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**

25

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.

27

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

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

I Semester (Chemistry Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE /MC	L	T	P	Total Credit	Contact Hours/ Week	CIE Marks	SEE Marks	Total Marks	Course category (As per AICTE)
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	L	T	P	Total Credit	Contact Hours/ Week	CIE Marks	SEE Marks	Total Marks	Course category (As per AICTE)
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	B20EN0102	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								

Course Title	Multivariable Calculus and Linear Algebra				Course Type		HC	
Course Code	**B20AS0105**	**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 familiarize students with important concepts coming under differential calculus and to develop strong foundations on these concepts. In Computer Science, Calculus is used for machine learning, data mining, scientific computing, image processing, and creating the graphics and 3D visuals for simulations. Calculus is also used in a wide array software program that require it. Linear algebra provides concepts that are crucial to many areas of computer science, including graphics, image processing, cryptography, machine learning, optimization, graph algorithms, information retrieval and web search.

COURSE OBJECTIVE (S):

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

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	e 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.

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	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	HC
Course Code	B22AS0104	Credits	3		Class	**I Semester**
	LTP	Credits	Contact Hours	Work Load	Total Number of	

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

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	-	-	-				

	Practical	1	2	2	Theory	Practical	CIE	SEE
	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 communicative strategie (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

									3					
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		✔	✔			

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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
THEORY

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:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
	Introduction to Arduino Board & getting stared with Arduino IDE software	Hardware & software	Identifications of various parts of Arduino
1	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	Arduino UNO, Arduino IDE, LED's	Arduino coding
2	Write a program to blink 4 LED in the given pattern 	Arduino UNO, Arduino IDE, LED's	Arduino coding, Looping structure
3	Write a program to blink an LED with different times and duration using the concept of user defined function	Arduino UNO, Arduino IDE, LED's	Arduino coding, user define function
4	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.	Arduino UNO, Arduino IDE, LED, PIR sensor	Interface PIR sensor
5	a) Write a program to increase and decrease the brightness of LED. b) Write a program to control the brightness of LED using Potentiometer	Arduino UNO, Arduino IDE, LED, Potentiometer	

6	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	Arduino UNO, Arduino IDE, LED, LDR	Interface LDR sensor
7	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	Arduino UNO, Arduino IDE, LCD, Temperature sensor	Interface Temperature sensor
8	Write a program to interface ultrasonic sensor and display the distance from an object.	Arduino UNO, Arduino IDE, Ultrasonic sensor	Interface Ultrasonic sensor
	Challenging Experiments		
9	a) Introduction to ESP module & programming using Arduino IDE software b) Write a program to demonstrates how to use Wifi module ESP8266-01 to blink LED (with simple LED)	ESP8266 Arduino Uno, LED, Arduino IDE	Interface of LED to ESP Module, Program ESP 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 | 17. | IoT based Patient Health Monitoring |

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

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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
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 Spectrophotometer	A better understanding the optical band gap of the materials. Able to perform experiment with

	UV-Visible spectroscopy.		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):

Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
1. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
2. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
3. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
4. Learn new algorithms and technologies in C Programming and apply for suitable application development.
5. 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:

PART A:			
No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**
1	Consider Loan applications in a bank consisting of various customer details such as Name, Organization, salary and loan amount applied. Segregate the loan applications based on income (low: <=5 lpa, medium: >5lpa <10lpa and high:>10lpa)	Condition checking	Apply if-else and switch
	Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are placed in the third file. Display the contents of DATA.	Files operations	Apply File concepts
2	Statistical measures are used for data analysis and interpretation. Develop program to determine the mean and stand deviation of data stored in an array.	Statistical Computing	Use Array and loops
	Consider the details of Airline passengers such as Name, PAN-No., Mobile-no, Email-id, Source, Destination, Seat-No and Air-Fare. Develop a program to read the details of airline passengers, store them in the structure "Airline" and List details of all the passengers who travelled From "Bengaluru to London".	Search technique	Apply Structures
3	Assume that Mr. Peterson shopped N items at Big Market and his Cart comprises of name of the item, cost of the item per UNIT and quantity. Read the details of shopping and store them in the structure "Shop". Compute the total amount spent on shopping at Big Market and also find out the item with minimum and maximum cost.	Statistical measure	Apply Structure and if then else
	b. Write a C program to define a structure named Student with name and DOB, where DOB in turn is a structure with day, month and year. Read the details of student and store them in the structure "Student". Display name and date of birth of students using the concept of nested structures.	Nested Structures	Apply Nested Structures
4	Consider a set of N students with SRN, name, and marks scored in 8 subjects. Read the details of students and store them in the structure "Student_Marks". Compute total marks and average marks of each student and display them with suitable headings.	Average computation and visualization	Apply Structure, Array and Loops
	b. Create the structure "Book" with book_id, title, author_name and price. Write a C program to pass a structure as a function argument and print the book details.	Functions	Passing structures to function
5	Assume that Ms. Jassica shopped N items at Amazon and the Cart comprises of name of the item, cost of the item per UNIT and quantity. Arrange the items in the increasing order of cost of the item per UNIT.	Sorting	Apply sorting the contents of structure.
	Write a C program to compute the monthly pay of "N" employees	Reading and storing data	Use structures for

	using each employee's name, Basic_Pay, DA and HRA. The DA and HRA are 80% and 30% of the Basic_Pay respectively. Gross-salary is computed by adding DA and HRA to Basic_Pay. Store all the details in an array of structures and print the name and gross salary of each employee.		reading and storing data
6	a. Consider the details of "N" Faculty members consisting of Name, EMP-ID,name of the school, address and salary. Create a file to store the above details. Retrieve the contents of the file to perform following operations: (i) Display the details of the faculty based on salary range entered. (ii) Display the details of the faculty based on the EMP-ID entered.	File operations	Create file, store data and display details.
	b. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if else and switch case.	String operations	Apply string functions
PART B:			
	Project 1: Address Contact List with the following modules: User Add User(Name, Address, Primary contact number, secondary contact number, E-mail ID) Delete User Search for User Edit Find and replace the user name Edit the contact (Phone Number) details. Edit the Address of the user Report List of users based on the starting letter of their names. List of users based on first 2 digits of their mobile number. List of users based on the domain name of their E-mail ID.		
1	Develop a program in C to create the structure "Contact" with the fields, user_name, address, mobile, phone1 and email_id. Read the data into the structure "Contact" and store them in the file "Contact.txt".	Structures and Files	Develop the program using Structures and Files
2	Develop a program in C to open contact list from the file "Contact.txt" in read mode and delete contact details of the person based on name of the person by searching his/her details. Display the updated list.	String, File and Linear Search	Develop the program using String and File
3	Develop a program in C to input the string,"Str1"(which can be either a mobile no. or name of the user) and search for it in the file , "Contact.txt" and display the details if it is found else display an error.	String, File and Linear Search	Develop the program using String and File
4	Develop a program in C to input the name of the user into the string, "Str1" , search for it in the file "Contact.txt" and replace the content of "Str1" with the new data if found.	String, File and Linear Search	Develop the program using String, File and apply linear search
5	Develop a program in C to input the phone number of user into the string, "Str1", search for it in the file "Contact.txt" and edit it with new data if found and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
6	Develop a program in C to input the address of the user and search for the same in the file, "Contact.txt" and edit the address with new address and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
7	Develop a program in C to input a letter into "Letter", compare it with the details stored in "Contact.txt" and then display the list of the users whose name begin with "Letter ".	File operations	Develop the program using file

8	Develop a program in C to input first two digits of a mobile number into "Mobile", search for the same in "Contact.txt" and display the details of all the users whose mobile number begin with "Mobile".	File operations	Develop the program using file
9	Develop a program in C to input a domain name of email-id and search for the same in the file, "contact.txt" and list the details of the users whose email-id matches with the given domain name.	File operations	Develop the program using file

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
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		Hard Core	
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 ARTICULATIONMATRIX

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/cours

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	B22AS0202	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	B22EN0201	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**					

Title	Probability and Statistics			Course Type		HC	
Course Code	B22AS0201	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, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}$ and $y = ax^b$ **Statistical Methods**: Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression, problems. Rank correlation. Applications in computer science

UNIT – 2
Probability distributions: Recap of probability theory (definition, addition rule, multiplication rule, conditional probability). Random variables, Discrete and continuous probability distributions. Binomial, Poisson, exponential and normal distributions (derivation of mean and variance for all distributions). Applications in computer science.
UNIT – 3
Joint Probability distribution : Joint Probability distribution for two discrete random variables (both discrete and continuous cases), expectation, covariance, correlation coefficient.   Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. Applications in computer science.
UNIT – 4
Sampling theory:-Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications in Computer Science.   **Introduction to queuing systems**: Single queuing nodes, service disciplines, M/M/1 Queuing system.

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		HC	
Course Code	B22AS0106	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	-	-	-	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:	B20EN0102	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 modeling 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

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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	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.

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

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. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company,2004.
4. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013

REFERENCE BOOKS:
1. B.V. Ramana, "Higher Engineering Mathematics", 19th edition, Tata McGraw Hill Publications, 2013.
2. 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. "Mastering Data Analysis in Excel" - https://www.coursera.org/learn/analytics-excel.
4. Data Science Math Skills, Duke University (https://www.coursera.org/learn/datasciencemathskills)
5. https://www.edx.org/course/subject/data-science
6. https://onlinecourses.nptel.ac.in/noc19_cs60/preview

SELF-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	PS01	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

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CO	Course Outcomes	POs	PSOs
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 lamina inclined to both HP and VP	Solid Edge Software	analysing and software skill
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/

Course Title	Physics for Computer science Lab				Course Type		FC	
Course Code	B22AS0109	Credits		1	Class		I 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#	CourseOutcomes	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	Determineparticle 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'SLEVELOFTHECOURSEOUTCOMES

CO#	Bloom'sLevel					
	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 oftheExperiment	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

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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 to 5, 8 to 10	1,2,3
CO2	Apply the SQL Queries in developing the real-world applications.	1 to 5, 8 to 10	1, 2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using regression algorithms.	1 to 5, 8 to 10	1, 2, 3
C04	Design ER diagrams for database.	1 to 5, 8 to 10	1, 2, 3
CO5	Use Excel to solve 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	1	1

CO2	2	2	2	2	2		1	3	3		3	2	2
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	2	2	2		1	3	3		3	3	3
CO6	3	3	2	2	2		1	3	3		3	3	3

List of Experiments

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
3	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.	MS Excel	Perform prediction and visualiza tion of data
4	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. 	Year	Month	Interest rate	Un employment rate	Stock index price
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2022	10	2.75	5.3	1464		MS Excel	Perform prediction and visualizatio n of data

5.	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. 	Sl.no	A	B
1	Principal	Rs.10,00,000
2	Annual interest rate	5.2%
3	Year of the loan	3
4	Starting payment number	1
5	Ending payment number	36
6	Total interest paid during period	?		MS Excel	Create Excel data and perform EMI estimator
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6	Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO should not be NULL.	SQL	Creating Tables
7	Create the customer database of a big Market with CUSTOMER_ ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_ CODE. Store at least twenty customer's details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.	SQL	Creating and retrieving Tables
8	Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.	MS Excel	Apply Linear regression
9	Apply Multiple linear regression to predict the factory products which is A, B and C are independent variables and cost dependent variable.	MS Excel	Apply Linear regression
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													
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
	Practical	-	-	-			SEE
	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

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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

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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.