

**10** YEARS  
OF UNIVERSITY  
RECOGNITION  
**20** YEARS OF  
ACADEMIC  
EXCELLENCE



**REVA**  
UNIVERSITY  
Bengaluru, India

**School of Computing and Information Technology**

**B.Tech. Computer Science and Information Technology  
2022-23 Batch**

# **HANDBOOK**

**Rukmini Knowledge Park  
Kattigenahalli, Yelahanka, Bengaluru – 560064  
[www.reva.edu.in](http://www.reva.edu.in)**

**SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY**

**HANDBOOK**

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

**2022-26**

Rukmini Knowledge Park,  
Kattigenahalli, Yelahanka, Bangalore - 560 064  
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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's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. 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.

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

Welcome to the portals of REVA University!

**Dr. M. Dhanamjaya**  
Vice-Chancellor, REVA University

## Director's Message

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

This handbook presents the B.Tech in Computer Science and Information Technology program curriculum. The program is of 4 years duration and split into 8 semesters. The courses are classified into foundation core, hard core, and soft core courses. Hard core courses represent fundamentals study requirements of B.Tech CSIT program. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Artificial Intelligence, Fuzzy Logic and Systems, Cognitive science and predictive analytics etc. Theoretical foundations of engineering, science, and Information Science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization.

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

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

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

**Dr. Mallikarjun M Kodabagi**

**Director, Computing and Information Technology**

## CONTENTS

Sl.No	Particulars	Page. no
1	Message from the Honorable Chancellor	02
2	Message from the Vice Chancellor	03
3	Message from Director	04
4	Rukmini Educational Charitable Trust	06
5	About REVA University Vision, Mission and Objectives	07
6	About School of Computing and Information Technology Vision Mission Advisory Board BoS	11
7	Program Overview Program Educational Objectives Program Outcomes Program Specific Outcomes Mapping of Course Outcomes with Program Outcomes Mapping Program Outcomes with Program Educational Objectives	12
8	Regulations Governing B.Tech programs	15
9	Curriculum- B. Tech in Computer Science and Information Technology	32

## 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<sup>th</sup> 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, Counsellors and Placement Officers.

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

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

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

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

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

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

## **Vision**

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

## **Mission**

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

## **Objectives**

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

## **About School of Computing and Information Technology**

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

### **School Vision**

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

### **School Mission**

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

### **Quality Policy**

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

1. Impart quality education by providing state of art curriculum, experimental learning, and state of the art labs.
2. Enhance skill set of faculty members through faculty development programs and interaction with academia and industries.
3. Inculcate the competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exhibition, Internship and Entrepreneurship Program.
4. Provide soft skill and skill development training for personality development and better placement.
5. Promote innovation and research culture among students and support faculty members for better research and development activity.

## **B. Tech Computer Science and Information Technology**

### **Program Overview**

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

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

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

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

The B. Tech. in Computer Science and Information Technology curriculum developed by the faculty at the School of Computing and Information Technology is outcome based and it comprises required theoretical concepts and practical skills in the domain. By undergoing this program, students develop critical, innovative, creative thinking and problem solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. The above mentioned

features of the program, advanced teaching and learning resources and experience of the faculty members with their strong connections with ICT sector makes this program unique.

### **Program Educational Objectives (PEO's)**

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

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

### **Program Outcomes (PO's)**

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

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering.
- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO-9: Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcomes (PSO's)**

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

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



# ACADEMIC REGULATIONS

## B. Tech., (4 years) Degree Programs

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

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

#### 1. Title and Commencement:

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

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

#### 2. The Programs:

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

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

### 3. Duration and Medium of Instructions:

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

**3.2** The medium of instruction shall be English.

### 4. Definitions:

**4.1 Course: "Course" means a subject, either theory or practical or both and project, listed under a program;**

Example: "Fluid Mechanics" in B. Tech Civil Engineering program, "Engineering Thermodynamics" in B. Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely: L, T and P, where,

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

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

P stands for **Practice** session and it consists of hands-on experience such as laboratory experiments, field studies, case studies, project based learning or course end projects and self-study courses that equip students to acquire the required skill component.

#### 4.2 Classification of Courses

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

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

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

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

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

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

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

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

Sl. No.	Program	Duration	Eligibility
			<p>/ Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects.</p> <p>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.</p> <p>E. Provided further that student, who have passed Diploma in Engineering &amp; 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.</p> <p>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)</p>
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					6
3	2	0	4:1:0	5	5
3	2	0	3:1:0	4	5
2	0	2	3:0:1	4	6
0	2	2	2:1:1	4	6
4	0	6	0:0:3	3	4
2	0	0	4:0:0	4	2
	0	0	2:0:0	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:

- Core Course (CC)
- Foundation Course (FC)
- Hard Core Course (HC)
- Soft Core Course (SC)
- Open Elective Course (OE)
- Skill Development Course (SDC)
- Mandatory Non Credit Course (MC)
- 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
<b>TOTAL CREDITS</b>				<b>160</b>	<b>168</b>

**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 marks

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.**

- 1<sup>st</sup> test is conducted for 20 marks during **8<sup>th</sup> week** of the Semester;
- 2<sup>nd</sup> test is conducted for 20 marks during **15<sup>th</sup> 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 **2<sup>nd</sup> 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 16<sup>th</sup> and 17<sup>th</sup> week of the semester.

9.8 SEE for 50 marks theory exam shall be held in the 18<sup>th</sup> 19<sup>th</sup> and 20<sup>th</sup> 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:

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

IA's 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 8 <sup>th</sup> week	First 50%	40	20	9 <sup>th</sup> week
2	Test -2	During 15 <sup>th</sup> Week	Remaining 50%	40	20	16 <sup>th</sup> Week
3	Assignment / Quiz - 1	Every week till Test-1	First 50%	10	05	9 <sup>th</sup> Week
4	Assignment / Quiz - 2	Every week during Test-1 and Test-2	Remaining 50%	10	05	16 <sup>th</sup> Week
5	SEE	18 <sup>th</sup> to 20 <sup>th</sup> Week	100%	100	50	20 <sup>th</sup> 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 8 <sup>th</sup> week	First 50%	25	12.5	8 <sup>th</sup> week
2	Test -2	During 15 <sup>th</sup> Week	Remaining 50%	25	12.5	15 <sup>th</sup> Week
5	SEE	18 <sup>th</sup> to 20 <sup>th</sup> Week	100%	50	25	20 <sup>th</sup> 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:

- Knowledge of relevant processes;
- Skills and operations involved;
- Results / products including calculation and reporting

**10.1 Assessment of lab courses**

**10.1.1 Assessment of Separate lab course**

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

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

**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
	<b>Total</b>	<b>10 marks</b>

**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
	<b>Total</b>	<b>50 marks</b>

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
	<b>Total</b>	<b>100 marks</b>

**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
	<b>Total</b>	<b>50 marks</b>

**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 ( $P = \frac{IA}{IA + SEE}$ ) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

**a. Computation of SGPA and CGPA**

The Following procedure to compute the Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) =  $\sum(C_i \times G_i) / \sum C_i$**  where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.

**Illustration for Computation of SGPA and CGPA**

**Illustration No. 1**

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	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 =  $159 \div 19 = 8.37$**

**Illustration No. 2**

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
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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 =  $175 \div 24 = 7.29$

### 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 =  $199 \div 24 = 8.29$

#### 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 :  $CGPA = \sum(C_i \times S_i) / \sum C_i$

Where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  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
<b>Cumulative</b>	<b>168</b>		<b>1348.56</b>

Thus,

$$CGPA = \frac{21 \times 6.83 + 23 \times 7.29 + 22 \times 8.11 + 24 \times 7.40 + 22 \times 8.29 + 24 \times 8.58 + 22 \times 9.12 + 10 \times 9.25}{168} = \frac{1348.56}{168} = 8.02$$

#### c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

**Illustration: CGPA Earned 8.02 x 10 = 80.2**

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

#### Classification of Results

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

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



< 4 CGPA	0	F	Unsatisfactory	Unsuccessful
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**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.

#### **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 8<sup>th</sup> 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 1<sup>st</sup> and 2<sup>nd</sup> semester together shall move to the 3<sup>rd</sup> 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 5<sup>th</sup> 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

7<sup>th</sup> semester of the succeeding year.

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

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

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

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

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

# SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

## SCHEME OF INSTRUCTIONS (2022 – 2026 BATCH)

### B. Tech CS & IT

#### I Semester (Chemistry Cycle)

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

#### II Semester (Physics Cycle)

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

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

Course Title	Multivariable Calculus and Linear Algebra				Course Type		FC	
Course Code	B20AS0103	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	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

- Explain the scalar and vector point functions and their operations.
- Illustrate how to find angle between polar curves with a suitable example.
- Demonstrate the use of radius of curvature of the curves can be best suited for machine learning techniques with big data analytics.
- 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	Evaluate the limit using L' Hospital rule after identifying an indeterminate form.	1,2,4	1
CO-4	Solve the given system of equations by Gauss elimination and Gauss Jordan method for the consistent equations.	1,2,4	1
CO-5	Determine 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
<p align="center"><b>UNIT - 1</b></p> <p><b>Introduction to Vector Differentiation:</b> Introduction, Scalar and vector point functions, velocity, acceleration, Gradient, Divergence, Curl, Laplacian, Solenoidal and Irrotational vectors, Vector identities.</p> <p><b>Differential Calculus-1:</b> 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.</p>
<p align="center"><b>UNIT - 2</b></p> <p><b>Differential Calculus-2:</b> Derivative of arc length – concept and formulae (without proof), Radius of curvature-Cartesian, parametric, polar and pedal forms (with proof) problems.</p> <p>Indeterminate forms and solution using L'Hospital's rule. Analysis of Randomized algorithms using Differential Calculus. Applications in computer science.</p>

### 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, 43<sup>rd</sup> edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9<sup>th</sup> edition, 2013.
4. Ron Larson, "Multivariable Calculus, Cengage Learning", 10th Edition, 2013.

#### REFERENCE BOOKS:

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

#### JOURNALS/MAGAZINE:

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

#### SWAYAM/NPTEL/MOOCs:

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

#### SELF-LEARNING EXERCISES:

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



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

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

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

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

#### COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the phenomenon of light and matter interaction to study the materials	1,2,3	1
CO2	Demonstrate the electrochemical processes & illustrate the method of preparation of solar grade silicon.	1,2,3,7	1
CO3	Select different materials in controlling the corrosion & fabrication of printed circuit boards (PCB).	<b>1,2,3,7</b>	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.	<b>1,2,3,6</b>	1
CO6	Use of promising materials for electrochemical energy storage and engineering, and environmental remedies.	<b>1,2,3,7</b>	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
<b>UNIT - 1</b> <b>Light and Matter Interaction</b> 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<sub>2</sub>) 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, 16<sup>th</sup> 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, 3<sup>rd</sup> Edition, 2014.

### Reference Books:

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

### JOURNALS/MAGAZINES:

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

### SWAYAM/NPTEL/MOOCs:

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

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

**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 and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).	10	
CO2	Develop the ability to write cohesively, coherently, and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic (Writing skills).	10	
CO3	Make use of reading different genres of texts by adopting various reading strategies (Reading Skills).	10	
CO4	Take part in interviews confidently and develop accurate writing skills.	10	

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY

Contents
<b>UNIT – 1</b> <b>Functional English:</b> Language as a Tool of Communication, - Effective Communication-Modes of Communication- Email communication - Giving Instructions.
<b>UNIT – 2</b> <b>Interpersonal Skills:</b> 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).
<b>UNIT - 3</b> <b>Multitasking Skills:</b> 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).
<b>UNIT – 4</b> <b>Persuasive Skills:</b> 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. Dixon, 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	-	-	-				
	<b>Total</b>	3	3	3	42	-	50%	50%

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to

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

#### COURSE OUTCOMES (COs)

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

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

# BLOOM'S LEVEL OF THECOURSE OUTCOMES

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

# COURSE ARTICULATIONMATRIX

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

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

# COURSE CONTENT THEORY

## Contents

### UNIT-1

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



## UNIT-2

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

## UNIT-3

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

## UNIT-4

**Structures & Union:** Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested 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", 2<sup>nd</sup> Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4<sup>th</sup> 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", 4<sup>th</sup> 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](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-LEARNING EXERCISES

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	-	-	-				
	Practical	-	-	-	Theory	Practical	CIE	SEE
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW

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

#### COURSE OBJECTIVES

The objectives of this course are to

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

#### COURSE OUTCOMES (COs)

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

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

**COURSE ARTICULATION MATRIX**

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

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

**COURSE CONTENT****Contents****UNIT-1**

**Introduction to Energy Systems:** Concept of heat and work, Steam formation, Types of steam, Steam properties, numerical on steam properties, Introduction to boilers, working of Babcock and Wilcox boiler.

**UNIT-2**

**Prime Movers:** Types and working principle of turbines, IC Engines, numerical on IC engines.

**Introduction to Refrigeration and Air Conditioning:** Working principle of refrigeration system, working of domestic refrigerator and window air conditioner

**UNIT-3**

**Materials and Manufacturing Processes:** Introduction to engineering materials and classifications, casting, Machine Tools- lathe & drilling machine, metal joining process-welding, brazing and soldering, modern manufacturing technology-CNC machines, laser engraving and 3D printing.

**UNIT-4**

**Machine Elements:** Types and applications of springs, belt drives, gear drives and chain drives, numerical on belt drives and gear trains.

**Introduction to Mechatronics and Robotics:** Need of Mechatronics in industries, measurement system, open and closed loop control system, Robot anatomy, applications of Robotics.

**TEXT BOOKS**

1. K R Gopala Krishna, Sudheer Gopala Krishna and S C Sharma, "Elements of Mechanical Engineering", Subhash Publishers, 13<sup>th</sup> 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 Promoters 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	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	<b>Total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>14</b>	<b>28</b>	<b>50%</b>	<b>50%</b>

#### 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 sensor; 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																																																																																
<b>Part-A</b>																																																																																			
	Introduction to Arduino Board & getting started 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 <div> <table> <tr><th colspan="4">Pattern</th></tr> <tr><td>L1</td><td>L2</td><td>L3</td><td>L4</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr> <tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> </table> <table> <tr><th colspan="4">Pattern</th></tr> <tr><td>L0</td><td>L1</td><td>L2</td><td>L3</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> </table> </div>	Pattern				L1	L2	L3	L4	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	OFF	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	Pattern				L0	L1	L2	L3	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Arduino UNO, Arduino IDE, LED's	Arduino coding, Looping structure
Pattern																																																																																			
L1	L2	L3	L4																																																																																
ON	OFF	OFF	OFF																																																																																
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OFF	OFF	OFF	OFF																																																																																
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																																																																																
<b>Challenging Experiments</b>																																																																																			
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/Subcriber 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)

<ol style="list-style-type: none"> <li>IoT based Automated Table Lamp</li> <li>IoT based Light Dimmer and Speed Controller</li> <li>IoT based Energy Monitor and Over Current Cut-off</li> <li>IoT based Smart Home Controller Using Blynk</li> <li>IoT based Motion Detector Using Cayenne</li> <li>IoT based Air Pollution Meter</li> <li>IoT based Smart Camera</li> <li>IoT based Pet Feeder</li> <li>IoT based Electronic Door Opener</li> <li>IoT based Underground Cable Fault Detector</li> <li>IoT based Air &amp; Sound Pollution Monitoring System</li> <li>IoT based Weather Reporting System</li> <li>IoT based Toll Booth Manager System</li> <li>IoT based Heart Attack Detection &amp; Heart Rate Monitor</li> <li>IoT based Person/Wheelchair Fall Detection</li> <li>IoT based Water Quality Monitoring System</li> </ol>	<ol style="list-style-type: none"> <li>IoT based Patient Health Monitoring</li> <li>IoT based Garbage Monitoring System</li> <li>IoT based Liquid Level Monitoring System</li> <li>IoT based Biometric Attendance System</li> <li>IoT based Irrigation Monitoring &amp; Controller System</li> <li>IoT based Gas Pipe Leakage Detector</li> <li>IoT based Alcohol &amp; Health Monitoring System</li> <li>IoT based Streetlight Controller System</li> <li>IoT based Traffic Signal Monitoring &amp; Controller System</li> <li>IoT based Fire Department Alerting System</li> <li>IoT based Antenna Positioning System</li> <li>IoT based Garbage Monitoring with Weight Sensing</li> <li>IoT based Colour Based Product Sorting Machine</li> <li>IoT based Smart Mirror with News &amp; Temperature</li> <li>IoT based Car Parking System</li> <li>IoT based Automatic Vehicle Accident Detection and Rescue System</li> </ol>
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#### TEXTBOOKS:

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

#### REFERENCE BOOKS:

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

#### SWAYAM/NPTEL/MOOCs:

- <https://www.coursera.org/learn/iot>
- <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	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	<b>Total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>14</b>	<b>28</b>	<b>50%</b>	<b>50%</b>

### 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	PS01	PS02	PS03
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
<p style="text-align: center;"><b>UNIT – 1</b></p> <p><b>Design Thinking Process:</b></p> <p>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.</p> <p><b>Empathizing:</b> Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies</p>
<p style="text-align: center;"><b>UNIT – 2</b></p> <p><b>Defining the problems:</b></p> <p>POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc.</p> <p>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</p> <p>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.</p>

### 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

Sl. No	Name of the Topic	Tools and Techniques	Expected Skill /Ability
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/M66ZU2PClM>

8. [https://thisisdesignthinking.net/2017/07/innogy\\_energy\\_ecarsharing/](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				
	<b>Total</b>	<b>1</b>	<b>2</b>	<b>2</b>	-	<b>28</b>	<b>50%</b>	<b>50%</b>

#### 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
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B

### LOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX

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

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

### Practice

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

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

**PART\_B: Projects**

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

**Text Books**

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

**Reference Books:**

1. J. Mendham, Vogel's "Quantitative Chemical Analysis", 6<sup>th</sup> 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				
	<b>Total</b>	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 LEVEL OF THE COURSE OUTCOMES**

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

# **COURSE ARTICULATION MATRIX**

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	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:**

Sl. NO.	PROGRAMS
1	Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a C program using switch statement to design a basic calculator that performs the basic operations such as addition, subtraction, multiplication and division.
2	People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a program to find the coefficients of a quadratic equation and compute its roots.
3	Consider the age of 3 persons in a family, Write a C program to identify the eldest person among three of them.
4	Consider student's marks in Computer Test. Write a C Program to display the grade obtained by a student in



	Computer Test based on range of marks.
5	In a stock market at the end of the day, summation of all the transactions is done. Write a C program using arrays to a) Display transactions IDs from 1 to 'n'. b) Find the sum of 'n' natural numbers.
6	In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a C program using 2-dimensional array to check for compatibility of two matrices and perform matrix Multiplication.
7	Implement a Program to read N integer numbers into a single dimensional array, sort them in ascending order using bubble sort technique and print both the given array and the sorted array with suitable headings.
8	Suppose students have registered for workshop, and their record is maintained in ascending order based on student ID's. Write a C program to find whether a particular Student has registered for that particular workshop or not using binary search.
9	In a memory game, you first enter a first string and again enter second string, Write a C program to check whether both the strings are same or not.
10	Write a C program to define a structure named Student with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth.

#### TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2<sup>nd</sup> Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4<sup>th</sup> 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", 4<sup>th</sup> edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker, "Computer Graphics C Version", second edition, Pearson Education, 2004.

Course Title	<b>Engineering Workshop</b>				Course Type		<b>HC</b>	
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	1,2,9	1,2

	of Toyota Innova and Toyota Fortuner cars		
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 ARTICULATION MATRIX

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

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

#### Part-A

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

#### Part-B

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

#### TEXT BOOKS

1. K.R. Gopalkrishna, "Elements of Mechanical Engineering", Subhash Publishers, 12<sup>th</sup> Edition, 2012.
2. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, "The Elements of Workshop Technology - Vol I & II", Media Promoters and publisher, 11<sup>th</sup> Edition, 2001.

#### REFERENCE BOOKS

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

#### JOURNALS/MAGAZINES

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

#### SWAYAM/NPTEL/MOOCs

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

#### II Semester (Physics Cycle)

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

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

#### 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,  
 $y = ax + b$ ,  $y = ax^2 + bx + c$ ,  $y = aebx$  and  $y = axb$

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

### UNIT – 2

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

### UNIT – 3

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

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

### UNIT – 4

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

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

#### TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 43<sup>rd</sup> edition Khanna Publishers, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9<sup>th</sup> 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", 19<sup>th</sup> Reprint edition, Tata McGraw Hill Publications, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", 4<sup>th</sup> 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", 5<sup>th</sup> 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](https://onlinecourses.swayam2.ac.in/cec20_ma01/preview)

**SELF-LEARNING EXERCISES:**

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



Course Title	Physics for Computer Science				Course Type	FC		
Course Code	B22AS0106	Credits	3		Class	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	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>28</b>	<b>50%</b>	<b>50%</b>

### 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
<b>UNIT – 1</b> <b>Wave mechanics:</b> 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. <b>Quantum Physics:</b> 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", 10<sup>th</sup> edition, John Wiley and Sons, New York, 2013
3. R. K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai 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", 3<sup>rd</sup> edition, CBS Publishers.

### REFERENCE BOOKS:

1. Charls Kittel, "Introduction to Solid State Physics", 8<sup>th</sup> Edition Wiley, Delhi, 2004
2. Arthur Beiser, "Concepts of modern Physics", 8<sup>th</sup> 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", 2<sup>nd</sup> edition Springer Publication, 2012.

### JOURNALS/MAGAZINE:

1. <https://www.codemag.com/Magazine/ByCategory/Python>
2. [http://ijaerd.com/papers/special\\_papers/IT032.pdf](http://ijaerd.com/papers/special_papers/IT032.pdf)
3. <https://iopscience.iop.org/article/10.1088/176596/423/1/012027https://ieeexplore.ieee.org/document/4160250>
4. Python for scientific computing

### SWAYAM/NPTEL/MOOCs:

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

### Self-Learning Exercises:

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

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

#### 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
CO4	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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
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
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## **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", 20<sup>th</sup> Edition, Pearson Education, 2016
2. S.N. Maheshwari, and. S. K. Maheshwari. "Financial Accounting". 5<sup>th</sup> Edition, Vikas Publishing House, New Delhi, 2012.
3. Dr. Jawaharlal, " Accounting theory and practices", 4<sup>th</sup> 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
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>28</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW:

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

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

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

CO6			✓			
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## COURSE ARTICULATION MATRIX

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

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

### Course Content Theory:

Contents
<p style="text-align: center;"><b>UNIT – 1</b></p> <p><b>Introduction to Microsoft Excel:</b></p> <p>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.</p>
<p style="text-align: center;"><b>UNIT – 2</b></p> <p><b>Introduction to Data Science:</b></p> <p>What is Data Science? Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents.</p> <p><b>Introduction to SQL:</b></p> <p>SQL: Basics of Structured Query Language, creation, insertion, updation, deletion, retrieval of tables by experimental demonstrations. Import SQL Database Data into Excel.</p>
<p style="text-align: center;"><b>UNIT – 3</b></p> <p><b>Data science components:</b></p> <p>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.</p>
<p style="text-align: center;"><b>UNIT – 4</b></p> <p><b>Data visualization using scatter plots, charts, graphs, histograms and maps:</b></p> <p>Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data.</p> <p><b>Application of Data Science</b></p> <p>Data science life cycle, Applications of data science with demonstration of experiments by using Microsoft Excel.</p>



**TEXT BOOKS:**

1. B.S. Grewal, "Higher Engineering Mathematics", 43<sup>rd</sup> edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", 3<sup>rd</sup> 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. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

**JOURNALS/MAGAZINES:**

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

**SWAYAM/NPTEL/MOOCs:**

1. Excel Skills for Business: Essentials, Macquarie University (<https://www.coursera.org/learn/excel-essentials>)
2. SQL for Data Science, University of California, Davis (<https://www.coursera.org/learn/sql-for-data-science>)
3. Data Science Math Skills, Duke University (<https://www.coursera.org/learn/datasciencemathskills>)
4. <https://www.edx.org/course/subject/data-science>
5. [https://onlinecourses.nptel.ac.in/noc19\\_cs60/preview](https://onlinecourses.nptel.ac.in/noc19_cs60/preview)

**SELF-LEARNING EXERCISES:**

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

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

### COURSE OVERVIEW

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

### COURSE OBJECTIVES

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

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

### COURSE ARTICULATION MATRIX

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

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

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

## COURSE CONTENT THEORY

Contents
<p style="text-align: center;"><b>UNIT – 1</b></p> <p><b>Introduction to Electrical Engineering:</b> 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.</p>
<p style="text-align: center;"><b>UNIT – 2</b></p> <p><b>Magnetic Circuits and Electrical Machines:</b> 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</p>
<p style="text-align: center;"><b>Unit-3</b></p> <p><b>Semiconductor Diodes and Transistors:</b> 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.</p> <p>Transistors: Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.</p>
<p style="text-align: center;"><b>Unit-4</b></p> <p><b>Digital Electronics and Number System:</b> 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.</p>

## 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		Assessment in	
	Lecture	3	3	3	Classes		Weightage	
	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
CO6	3	3	1	1	3									3		3

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

Contents
<p align="center"><b>Unit-1</b></p> <p><b>Introduction to Civil Engineering:</b> Scope of Civil Engineering. Effect of the infrastructural facilities on socio-economic development of a country.</p> <p><b>Introduction to Engineering Mechanics:</b> 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.</p>
<p align="center"><b>Unit-2</b></p> <p><b>Analysis of Force system:</b>Composition of coplanar - non- concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar concurrent and non-concurrent force systems.</p> <p><b>Equilibrium of Coplanar Forces</b> Definition of static equilibrium, Conditions of static equilibrium for different coplanar force systems, Concept of Free Body Diagram and Lami's theorem with problems.</p>

### 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	-	-	-				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Total	3	4	4	28	28	50 %	50 %

### COURSE OVERVIEW

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

### COURSE OBJECTIVES

The objectives of this course are to

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

### COURSE OUTCOMES (COs)

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

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

### COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
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
<b>Unit-1</b> <b>Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software.</b> 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.
<b>Unit-2</b> <b>Solids:</b> Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.
<b>Unit-3</b> <b>Sections of solids:</b> 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
<b>Unit-4</b> <b>Isometric Projections:</b> 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



Sl.No	Practice	Tools and Techniques	Expected Skill /Ability
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, 1<sup>st</sup> 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, 53<sup>rd</sup> Edition, 2019.

#### REFERENCE BOOKS

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

SWAYAM/NPTEL/MOOCs

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

Course Title	Physics for Computer science Lab				Course Type	FC		
Course Code	B22AS0109	Credits	1		Class	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 basic understanding about the working of different electronic components. This course also teaches students to simulate the working of some electronic components.

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Constructing simple circuits and perform experiments to study voltage-current response.	1, 2,3 4	1,2,3
CO2	Determine the band gap of a semiconducting material.	1,2, 3,5	2, 3
CO3	Determine the dielectric constant of the material.	2,3, 4, 8,	1, 2, 3
CO4	Analyze the response of the circuit by combining the electrical/electronic components.	2,3, 4,8,	1, 2, 3
CO5	Determine particle size of the powder and wavelength of the LASER.	1 to 5	1, 2, 3
CO6	Simulate the working of electronic circuits	1 to 5, 8 to 10	1,2, 3

# BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

## List of Experiments

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Determine the value of Planck's constant using LEDs.	LED's, voltmeter and power-supply, Planck's constant apparatus set up, patch cards	Circuit construction and mathematical calculations
2	Study the i-v characteristics of a Zener diode.	Zener diode, DC supply, Ammeters and voltmeters	Circuit construction and mathematical calculation, graph plotting
3	Study the i-v characteristics of a "nnp" 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 ammeter	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				
	<b>Total</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>28</b>	<b>50</b>	<b>50</b>

#### COURSE DESCRIPTION:

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Microsoft Excel in developing the real-world applications.	1, 2, 4,10	1,2,3
CO2	Apply the SQL Queries in developing the real-world applications.	1,2, 3,9,10	2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using regression algorithms.	2,3, 4, 8,9, 10	1, 2, 3
CO4	Design ER diagrams for database.	2,3, 4,8, 9, 10	1, 2, 3
CO5	Illustrate modeling in Multiple Linear Regression.	1 to 5, 8 to 10	1, 2, 3
CO6	Demonstrate the Logistic Regression to predict the Data.	1 to 5, 8 to 10	1,2, 3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

C04			✓	✓	✓	✓
C05		✓				
C06			✓			

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	2	2	2			1	3	3			3	3	3
C02	2	2	2	2	2			1	3	3			3	3	3
C03	3	3	2	2	2			1	3	3			3	3	3
C04	3	3	3	2	2			1	3	3			3	3	3
C05	3	3	3	2	2			1	3	3			3	3	3
C06	3	3	3	2	2			1	3	3			3	3	3

#### Practice:

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

3	<p>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.</p> <p>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.</p>	MS Excel	Perform prediction and visualization of data																					
4	<p>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.</p> <table><tr><th>Year</th><th>Month</th><th>Interest rate</th><th>Un employment rate</th><th>Stock index price</th></tr><tr><td>2022</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr></table>	Year	Month	Interest rate	Un employment rate	Stock index price	2022	10	2.75	5.3	1464	MS Excel	Perform prediction and visualization of data											
Year	Month	Interest rate	Un employment rate	Stock index price																				
2022	10	2.75	5.3	1464																				
5.	<p>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.</p> <table><tr><th>Sl.no</th><th>A</th><th>B</th></tr><tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr><tr><td>2</td><td>Annual interest rate</td><td>5.2%</td></tr><tr><td>3</td><td>Year of the loan</td><td>3</td></tr><tr><td>4</td><td>Starting payment number</td><td>1</td></tr><tr><td>5</td><td>Ending payment number</td><td>36</td></tr><tr><td>6</td><td>Total interest paid during period</td><td>?</td></tr></table>	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
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	?																						
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", 43<sup>rd</sup> edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", 3<sup>rd</sup> 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. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

#### **JOURNALS/MAGAZINES:**

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



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

#### COURSE OVERVIEW

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

#### COURSE OBJECTIVES

The objectives of the course are to

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

#### COURSE OUTCOMES (CO'S)

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

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

#### COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### List Experiment

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	To verify KCL and KVL	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2	Study and Analysis of Lead & Lag networks by using R-C components.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
3	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring	Two-way switch or staircase wiring Kit	Connection, Working & application of Two-way switch
4	Study and analysis the Characteristics: light sensor and temperature sensor	Sensor kit	Characteristics of sensors
5	Study and analysis of V-I Characteristics of Zener PN Junction diodes (Both Forward and Reverse Characteristics).	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
6	Study and analysis of Transistor as switch	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor of rectifiers
8	Design of Clippers and clippers 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, 5th Systems", Pearson Edition, 2007.
2. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.

#### SWAYAM/NPTEL/MOOCs

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

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

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

*Students are expected to involve in planting a tree and nurturing till the completion of their degree program. Successful maintenance of tree is considered to be one of the eligibility criteria 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 plantation 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
<b>Unit 1: Introduction:</b> The tropical region, Benefits and costs of urban and community forests
<b>Unit 2: General Guidelines for Selecting and Placing Trees</b> 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
<b>Activity based learning</b>
Every student has to thoroughly understand the significance of planting a tree, identify type of tree and place to be planted, plant a tree and nurture till the completion of the degree.

##### Text Books:

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

**Reference Books:**

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

**Evaluation of this course**

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

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

**Summary of Internal Assessment and Evaluation Schedule**

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

**Additional guidelines for conducting this course**

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

1. Classes will be conducted by the nominated faculty (one hour per week) as per the syllabus.
2. Flipped classes, field experiences, group discussions and seminars can be used by the faculty so as to engage the students through student centric learning mechanisms
3. Students should be involved into understanding cause and effects of climate change, types of pollutions, and environmental hazards
4. Quizzes and debates on climate change and global warming can be arranged for each section
5. Students should plant the suitable tree and nurture
6. "Team Vanamahotsava" – A Central assistance team from REVA University will support for identifying trees, place and organizing plantation drives.
7. Regular progress review is planned to be monitored by digital system – an advanced version of current progress monitoring App.
8. School Directors are responsible to oversee all the arrangements and progress monitoring of this drive.

9. Frequent school level and university level branding shall be arranged to give awareness of this noble drive among all the stake holders such as parents, alumni, industry and academic partners, government sectors, NGO's, ministries, and the society.
10. Regular plant maintenance drive can be planned by "Team Vanamahotsava". However, planting a tree and its nurture responsibility solely rests on individual students.
11. Successful maintenance of tree is considered to be one of the eligibility criteria for the award of university degree.

## Semester - 3

Course Title	Discrete Mathematics and Graph Theory				Course Type		Theory	
Course Code	B22AS0301	Credits	4		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	4	4				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	1	1	1				
	<b>Total</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>42</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives and quantifiers	1 to 4	2
CO2	Apply the operations like union and intersection on discrete structures such as sets, relations and functions	1 to 3, 5,6	2
CO3	Make use of graph and fundamental theorems in real world applications	1 to 6	2
CO4	Develop a model using advanced concepts of graph for real world applications	1,2,4,5,6	2
CO5	Apply the mathematical foundation for advanced mathematics	1 to 3, 5,6	2

CO6	Solve the complex problems in most of the areas of Computer Science	1,2,3,4	3
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### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX

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

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

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

**Set Theory and Logic:** Fundamentals of Sets, Sub sets, Venn diagram, Operations on sets, Laws of set theory, Countable and Uncountable sets, Addition Principle, Extended Addition Principle, Propositions, Logical Connectives and truth tables (Illustrative Examples), Logical equivalence, Laws of logic, Duality, NAND and NOR connectives (Circuits), Converse, Inverse and Contra positive, Rules of Inference, Open statements, Quantifier, Logical implication involving quantifiers, Statement with more than one variable. Methods of Proofs and Disproof.



## UNIT – 2

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

## UNIT – 3

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

## UNIT – 4

**Euler and Hamiltonian graphs and Graph colouring:** Operation on graphs, Definition of Euler Trail, Euler Graphs, Hamiltonian path, Hamiltonian Cycle, Hamiltonian Graphs, Standard Theorems on Euler and Hamiltonian graphs, planar graph, detection of Planarity, Dual of planar graphs, Euler formula for planar graph, Graph colouring, Chromatic polynomial, Map coloring, Four Color Theorem, Five Color Theorem, Matching, Network flow, and its applications, Cut set, Cut vertex, Chord, Properties of Cut Sets, Max Flow Min Cut Theorem.

### TEXT BOOKS:

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

### REFERENCE BOOKS:

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

### JOURNALS/MAGAZINES

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

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/111/107/111107058/>
2. <https://nptel.ac.in/courses/106/103/106103205/>
3. [https://onlinecourses.swayam2.ac.in/cec20\\_ma02/preview](https://onlinecourses.swayam2.ac.in/cec20_ma02/preview)
4. [https://onlinecourses.nptel.ac.in/noc20\\_ma05/preview](https://onlinecourses.nptel.ac.in/noc20_ma05/preview)
5. [https://onlinecourses.swayam2.ac.in/cec20\\_ma03/preview](https://onlinecourses.swayam2.ac.in/cec20_ma03/preview)
6. <https://www.coursera.org/learn/graphs>

Course Title	Professional Ethics				Course Type		Theory	
Course Code	B22AH0301	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>28</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

It also helps to know the meaning of ethics and need of ethics in personal and professional life.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss different types of ethics.
2. Explore ethical standards followed by different companies.

### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the professional ethics and human values.	1 to 5, 7,8 ,12	2
CO2	Summarize ethical standards followed by different companies.	1 to 5,7,8,12	2,3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY:

#### UNIT – 1

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

#### UNIT – 2

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

### TEXT BOOKS:

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

Course Title	ENTREPRENEURSHIP				Course Type	Theory		
Course Code	B22CI0309	Credits	1		Class	III semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>14</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Course Description: This is an *introductory course* is designed to provide the foundational concepts of *entrepreneurship*, including the definition of *entrepreneurship*, the profile of the *entrepreneur*, and the role of venture creation in society. The course also provides a bird's eye view on the steps to start a venture, financing, marketing as well as support by various institutions towards entrepreneurship.

#### COURSE OBJECTIVE

1. To understand the basic terms, concepts in Entrepreneurship Development
2. To apply for the supporting schemes towards entrepreneurship

#### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the key terms, definitions, and concepts used in Entrepreneurship Development	1	1
CO2	Plan a startup and understand sources available for finance and the supporting schemes offered by state and central governments and other entrepreneurial development organizations	1,2	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	√	√	√			

#### COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT THEORY

Contents
<b>UNIT-1</b> <b>INTRODUCTION TO ENTREPRENEURSHIP:</b> Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Psychological factors, Social factors, Economic factors, Environmental factors. Characteristics of an entrepreneur, Difference between Entrepreneur and Entrepreneurship, Types of entrepreneurs. New generations of entrepreneurship viz. social entrepreneurship, Entrepreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving
<b>UNIT-2</b> <b>INSTITUTIONAL SUPPORT FOR ENTREPRENEURSHIP:</b> Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs

### TEXT BOOKS:

1. K. Ramachandran, "Entrepreneurship Development", Tata Mc. Graw Hill, 2008.
2. Sangeeta Sharma, "Entrepreneurship Development", PHI Publications, 2016.

### REFERENCE BOOKS:

1. Baringer and Ireland, "Entrepreneurship", 11th Edition, Pearson, 2020.
2. P. Narayana Reddy, "Entrepreneurship – Text and Cases", Cengage Learning India, 1st edition, 2010
3. Paul Burns, "Corporate Entrepreneurship: Building The Entrepreneurial Organization", Palgrave Macmillan.
4. Drucker F Peter, "Innovation and Entrepreneurship", 1985. Heinemann, London.
5. Doanld F Kuratko & Richard M, "Entrepreneurship in the New Millennium", India Edition.

### JOURNALS/MAGAZINES

1. International Small Business Journal: <https://journals.sagepub.com/home/isb>
2. Journal of Development Entrepreneurship: <https://www.worldscientific.com/worldscinet/jde>

### SWAYAM/NPTEL/MOOCs:

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

### SELF-LEARNING EXERCISES:

1. Introverts participate. If you have a few vocal students asking questions and little participation from others, anonymous questions lower student anxiety, which makes it easier for everyone to participate.
2. You learn what students are thinking about. Anonymity provides cover for students to ask questions they may be too afraid to ask but are curious about.
3. Discussions start. Anonymity means you can invite students to pose "challenging" questions. If you encourage your students to question what they're learning, why it's important, or why they should have to do the work you're assigning, you spark discussions about how entrepreneurship is relevant, which can often be the key to increasing engagement.

#### **PROBLEM BASED LEARNING**

No.	
1	How to write a Business Plan
2	Creating Marketing, Financial and Organizational Plans.
3	How to apply for financial assistance via various schemes
4	How to file taxes as a Small Business and understand the importance of GST

Course Title	Technical Documentation				Course Type		Theory	
Course Code	B22CI0308	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	14Hrs / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Total	1	1	1	14	0	25	25

### COURSE OVERVIEW:

The goal of this course is to prepare engineering students with the individual and collaborative technical writing, presentation, and research skills necessary to be effective technical communicators in academic and professional environments

### COURSE OBJECTIVE (S):

The objectives of this course are:

1. Understanding the characteristics of technical writing and the importance of purpose, audience, and genre for written communication in technical fields.
2. Planning, drafting, revising, editing, and critiquing technical and professional documents through individual and collaborative writing.
3. Writing effective technical documents that are grammatically and stylistically correct.
4. Explain the knowledge and skills required for undertaking a research project, for presenting a conference paper and for writing a scientific article.

### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Describe the characteristics of technical writing and	1 to4,8,9,12	1
CO2	Develop professional documents through individual	1to3,5,9,12	1
CO3	Write effective technical documents that are grammatically and Stylistically correct	1 to5,9,12	2
CO4	Writing effective paper for conference or journal publication	1,4,5,9,12	1
CO5	Understand the current resources for locating secondary information, and also understand the strategies of effective primary data gathering.	1to3,5,9,12	2
CO6	Explore different format features in both print, multimedia and html documents, and develop document design skills	1 to5,9,12	2



## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2				1	1			1
CO2	3	2	3		2				1			1
CO3	3	1	2	1	2				1			1
CO4	3			2	2				1			1
CO-5	3	2	3		2				1			1
CO6	3	1	2	1	2				1			1

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

## COURSE CONTENT THEORY

### Contents

#### -UNIT-1

**Introduction Technical Reports:** Importance of Reports, Objectives of Reports , characteristics of a Report , Categories of Reports, Informative Reports , Analytical Reports , Periodic and Special Reports , Oral and Written Reports , Long and Short Reports , Formal and Informal Reports , Individual and Group Reports , Formats , Prewriting , Purpose and Scope , Audience, Sources of Information , Organizing the Material , Interpreting Information , Making an Outline , Structure of Reports (Manuscript Format), Prefatory Parts , Main Text , Supplementary Parts , Types of Reports , Writing the Report , First Draft , Revising, Editing, and Proofreading.

**Technical Proposals:** Introduction, Definition and Purpose, Types, Characteristics, Structure of Proposals, Prefatory Parts, Body of the Proposal, Supplementary Parts, Style and Appearance, Evaluation of Proposals.

**Research Papers and Technical Descriptions:** Introduction, Research Paper, Characteristics, Components, Technical Description, Guidelines for Writing Good Descriptions, Checklist.

#### TEXTBOOKS:

1. Meenaxi Raman and Sangeetha Sharma, "Technical Communication", Oxford University press, 2015.
2. C. R. Kothari, Research Methodology Methods and Techniques, 2nd. ed. New Delhi: New Age International Publishers, 2009.
3. R. Panneerselvam, Research Methodology, New Delhi: PHI, 2005.
4. P. Oliver, Writing Your Thesis, New Delhi: Vistaar Publications, 2004.
5. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004.

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

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs)

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

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

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT THEORY

Contents
<b>UNIT-1</b> <b>Introduction to Computer Fundamentals:</b> Computer Components, accessories, specifications of computers and external devices. Flowchart symbols and guidelines, types and advantages, Algorithm design. <b>Python Fundamentals:</b> Introduction to Python: History, Applications, Your First Python Program, Constants, Variables, Naming conventions, simple data types, Type casting, Assignment statements, expressions, Boolean data type, Trigonometry functions, operators, precedence of operators, libraries, keywords, Python Collections, I/O statements, conditional statements, loops, functions, user defined functions. Introduction to GitHub and applications.
<b>UNIT-2</b> Strings: Unicode, Formatting Strings, Format Specifiers, other Common String Methods, Slicing a String. Regular Expressions: Case Study: Street Addresses, Case Study: Roman Numerals, Checking for Thousands, Checking for Hundreds, Using the {n,m} Syntax, Checking for Tens and Ones.
<b>UNIT-3</b> Object Oriented Programming: Defining Classes, The init() Method, Instantiating Classes, OOP features: Abstraction. Encapsulation, Single Inheritance, Polymorphism. Files: Reading from Text Files, Writing to text files, Reading and Writing the Binary Files.
<b>UNIT-4</b> NumPy: Introduction to NumPy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output. Pandas and Data Visualization: Introduction, Series and Data Frames in pandas and Data Visualization.

## TEXT BOOKS:

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

**REFERENCE BOOKS:**

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

**JOURNALS/MAGAZINES**

1. <https://www.codemag.com/Magazine/ByCategory/Python>
2. [http://ijaerd.com/papers/special\\_papers/IT032.pdf](http://ijaerd.com/papers/special_papers/IT032.pdf)
3. <https://iopscience.iop.org/article/10.1088/1742-6596/423/1/012027>
4. <https://ieeexplore.ieee.org/document/4160250>

**SWAYAM/NPTEL/MOOCs:**

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

**SELF-LEARNING EXERCISES:**

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

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

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

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

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX

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

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

### COURSE CONTENT

#### THEORY:

<b>UNIT – 1</b>
Introduction to Data structures and Algorithms: Data, Data Types, Abstract Data Types and Examples, Algorithms, Arrays: One Dimensional and Two Dimensional, Structures: Introduction to structures and nested structures.
<b>UNIT – 2</b>
Data Structures-1: Stacks, Evaluation of expressions: Infix, Prefix, postfix; Queues: Simple, circular and priority Queues.
<b>UNIT – 3</b>
<b>Data Structures-2:</b> Pointers; Dynamic memory allocation; Linked List: singly linked list, doubly linked list, stack using linked list, queue using linked list.
<b>UNIT – 4</b>
<b>Data Structures-3:</b> Trees: Binary Tree, Binary Tree Traversals, Binary search Tree

#### TEXT BOOKS:

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

#### **REFERENCE BOOKS:**

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

#### **JOURNALS/MAGAZINES**

1. <https://www.imedpub.com/scholarly/data-structure-journals-articles-ppts-list.php>
2. [https://www.mdpi.com/journal/algorithms/special\\_issues/Efficient\\_Data\\_Structures](https://www.mdpi.com/journal/algorithms/special_issues/Efficient_Data_Structures)
3. <https://ieeexplore.ieee.org/document/4055607>
4. <https://ieeexplore.ieee.org/abstract/document/6312216>
5. <https://www.sciencedirect.com/science/article/pii/S0022000083900065>
6. <https://www.sciencedirect.com/journal/journal-of-algorithms>

#### **SWAYAM/NPTEL/MOOCs:**

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

#### **Self-Learning Exercises:**

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



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

## COURSE OVERVIEW

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

## COURSE OBJECTIVE (S):

The objectives of this course are to:

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

## COURSE OUTCOMES (COs)

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

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

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY:

<b>UNIT – 1</b> <b>Filters and Oscillators:</b> Clipping and clamping circuits using diodes, Oscillator operation, Phase shift Oscillator, Wien bridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only) Simple design methods of Oscillators.
<b>UNIT- 2</b> <b>Operational Amplifiers:</b> Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters-First order LPF and HPF, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier-Log and antilog amplifier.
<b>UNIT – 3</b> <b>Principle and Minimization Techniques of combinational Circuits:</b> Introduction to combinational logic, Minimization Techniques: Min term, Max term, Sum of Products (SOP), Product of Sums (POS), 3 and 4 Variable Karnaugh map.
<b>UNIT – 4</b> <b>Analysis of Combinational and sequential Circuits:</b> Half adder, full Adder, Half Subtractor, full Subtractor, multiplexers and De multiplexers. Introduction to Sequential circuits: flip-flops: SR, JK, D, T Characteristic tables and equations; Application of Shift register (Ring Counter and Johnson counter) .

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**JOURNALS/MAGAZINES**

1. <https://ieeexplore.ieee.org/document/1085417>
2. [https://www.academia.edu/Documents/in/Digital\\_Electronics](https://www.academia.edu/Documents/in/Digital_Electronics)
3. [https://www.mdpi.com/journal/electronics/special\\_issues/circuit\\_machine\\_learning](https://www.mdpi.com/journal/electronics/special_issues/circuit_machine_learning)

**SWAYAM/NPTEL/MOOCs:**

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

Course Title	Theory of Computation				Course Type		Theory	
Course Code	B22CI0304	Credits	3		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs)

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

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

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX:

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

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

### COURSE CONTENT THEORY

Contents
<b>UNIT-1</b> <b>Introduction to finite automata:</b> Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata
<b>UNIT-2</b> <b>Regular Expressions,</b> regular languages, and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;

### **UNIT-3**

**Context free Grammars and Normal forms:** Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.

### **UNIT-4**

**Push Down Automata and Turing Machine:** Push down automata (PDA); Languages of a PDA; Deterministic PDA; Turing Machine.

#### **TEXT BOOKS:**

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

#### **REFERENCE BOOKS:**

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

#### **JOURNALS/MAGAZINES**

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

#### **SWAYAM/NPTEL/MOOCs:**

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

#### **Self-Learning Exercises:**

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

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

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs)

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

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

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

### COURSE ARTICULATION MATRIX

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

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

### PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			
1.	a). "LIST1" is a list that contains "N" different SRN of students read using a user defined function with the help of input () function. It is required to add SRN of "M" more students that are to be appended or inserted into "LIST1" at the appropriate place. The program must return the index of the SRN entered by user.	Windows/Linux OS, IDE, Jupiter	Create and perform operations on list.
	b)"TUPLE1" and "TUPLE2" are two tuples that contain "N" values of different data types read using the user defined function "READ" with the help of input() function. Elements of "TUPLE1" and "TUPLE2" are to be read one at a time and the "larger" value among them should be placed into "TUPLE3". Display all tuples.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on Tuples.
2.	a)SET1 and SET2 are two sets that contain unique integers. SET3 is to be created by taking the union or intersection of SET1 and SET2 using the user defined function Operation (). Perform either union or intersection by reading choice from user. Do not use built in functions union () and intersection () and also the operators " " and "&".	Windows/Linux OS, IDE, Jupyter	Create and perform Union and Intersection, Operations on Sets.
	b)The Dictionary "DICT1" contains N Elements and each element in dictionary has the operator as the KEY and operand's as VALUES. Perform the operations on operands using operators stored as keys. Display the results of all operations.		Create dictionary and perform operation using user defined function.



3.	a) A substring "Substr" between index1 and index2 is to be extracted from the given input string "Str1", which is read using input(). Display the substring "Substr" using a user defined function if available in string "Str1", otherwise display NULL.	Windows/ Linux OS, IDE, Jupyter	String operations.
	b) A string containing multiple words is to be read from the user one at a time, after reading perform following operations. Convert all the strings to uppercase and display Split the words of a string using space as the separation character and display.		
4.	a) Consider the text file, "Std.txt", with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, "Std.txt" and display the details of all the students of 4 <sup>th</sup> Semester "A" Section who have scored more than 75%.	Windows/ Linux OS, IDE, Jupyter	File Handling.
	b) Consider the text file "Emp.txt", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following: TOTAL_DEDUCTIONS= (LIC+PF) GROSS_SALARY= BASIC_SALARY+ DA NET_SALARY= GROSS_SALARY – TOTAL_DEDUCTIONS. Write the above data to file for each employee. Read the content of "Emp.txt" and display the details of each employee		File Handling.
5.	a). A "CAR" has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACTURING_YEAR and PRICE. A Class is required to be created for "CAR" to store the above attributes and perform the following operations: Get the details of "CAR" object from user and store into Array of objects Display the details of "CAR" object based on "COMPANY", "MODEL" and "PRICE".	Windows/ Linux OS, IDE, Jupyter	Classes and objects usage.
	b). Airline Reservation System contains the attributes of passengers such as NAME, PAN_NO, MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for "Airline" with the above attributes and perform the following operations: Get the details of "Airline" object from user and store into Array of objects List details of all the passengers who travelled From "Bengaluru to London". List details of all the passengers who travelled From "Chicago to Beijing" on 10 <sup>th</sup> of Feb, 2020.		
6.	a). "Arr_1" is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the Diagonal elements of "Arr_1" Elements of m <sup>th</sup> row (row no should be entered by user) Elements of n <sup>th</sup> column (column no should be entered by user)	Windows/ Linux OS, IDE, Jupyter	NumPy arrays usability.
	b) The dictionary "DICT1" contains the pass percentage of each semester of B. Tech in CSE, where, "Semester" acts as the key and "Pass Percentage" acts as the value. A Python Pandas dataframe is required to be created using the dictionary "DICT1" and display it using a user defined function.		Pandas Series usability.

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

13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/ Linux OS, IDE, Jupyter	Module integration and project development.
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#### TEXT BOOKS:

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

#### REFERENCE BOOKS:

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

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

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

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

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## PRACTICE:

1	Design, Develop and Implement a menu driven Program in C for the following Array operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. Support the program with functions for each of the above operations.
2	Design, Develop and Implement a Program in C for the following operations on Strings a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: c. Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. d. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Note: Don't use Built-in functions
3	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack

	f. Exit Support the program with appropriate functions for each of the above operations
4	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %( Remainder), ^ (Power) and alphanumeric operands.
5	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks 21 6 Design, Develop and Imp
6	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion and Deletion at End of SLL d. Perform Insertion and Deletion at Front of SLL e. Demonstrate how this SLL can be used as STACK and QUEUE f. Exit
8	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue f. Exit
9	Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ b. Find the sum of two polynomials $POLY1(x,y,z)$ and $POLY2(x,y,z)$ and store the result in $POLYSUM(x,y,z)$ Support the program with appropriate functions for each of the above operations
10	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Delete an element(ELEM) from BST e. Exit

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

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs)

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

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

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

#### COURSE ARTICULATION MATRIX

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

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



**PRACTICE:**

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

## Semester - 4

Course Title	Numerical Methods and Optimization Techniques				Course Type		Theory	
Course Code	B22AS0401	Credits	4		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	4	4				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	1	1	1				
	<b>Total</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>42</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW:

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

### COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply numerical methods to obtain approximate solutions for mathematical problems.	1 to 3, 12	1
CO2	Determine suitable interpolation formula and quadrature formulae to find the solution for the given data.	1 to 4 ,12	2
CO3	Solve the matrix associated with liner transformation with respect to the given base and understand the relationship between the operation and linear transformations and their corresponding matrices.	1 to 5,	3
CO4	Develop mathematical equations with simplex method and Transportation-Assignment problem for linear programming	1 to 5,12	1,2,3
CO5	Learn new tools and technologies in the Numerical Methods and apply for suitable application development.	12	2,3
CO6	Develop solutions in the Numerical Methods to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	2,3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT THEORY:

### UNIT – 1

**Numerical Methods:** Errors in Numerical Calculations Types of Errors-Significant Digits- Programming Errors- Numerical Solution of Non-Linear Equations-Bisection Method-Regula Falsi Method-Newton Raphson Method –Fixed Point Method of Iteration – Rates of Convergence of These Methods. Solutions of Algebraic Equations, Relaxation Method and Gauss Seidel Iteration Method.

### UNIT – 2

**Numerical Analysis:** Finite Differences-Operators ( $\Delta$ ,  $\nabla$  and  $E$ ), Interpolation, Newton-Gregory Forward Interpolation Formula, Central Difference, Stirling And Bessel's Interpolation Formulae, Lagrange's Interpolation Formula, Inverse Interpolation Formula, Divided Difference Formula, and Newton's Divided Differences Formula. Numerical integration: Newton-Cotes quadrature formulae: Trapezoidal, Simpson's rules and Weddle's rule.

### UNIT – 3

**Vector Spaces and Linear transformations:** Bases, Echelon forms, Rank, and determinants. Gauss elimination and its complexity, Inner products, Gram-Schmidt orthogonalization. Linear

transformations.

#### UNIT – 4

**Linear Programming:** Introduction, Canonical and Standard Form of LPP-Simplex Method-Big M Method- Two Phase Method-Principle of duality-Dual Simplex Method. Transportation Problem and Assignment problem.

#### TEXTBOOKS:

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

#### REFERENCES

1. KanthiSwarup, P.K. Gupta, Man Mohan, "Operations research", Sultan Chand & Sons. (module II), 5<sup>th</sup> edition.
2. Froberg, "Introduction to Numerical Analysis", Second Edition, Addison Wesley
3. Gerald and Wheatley, "Applied Numerical Analysis", Pearson Education Asia, Sixth Edition
4. S.S Rao, "Optimization Theory and Applications", Wiley Eastern
5. Grawin W. W, "Introduction of Linear Programming", McGraw Hill.

#### JOURNALS/MAGAZINES

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

#### SWAYAM/NPTEL/MOOCs:

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

#### Self-Learning Exercises:

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

Course Title	Universal Human Values				Course Type		Theory	
Course Code	B22AH0302	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>28</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

## COURSE OVERVIEW

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

## COURSE OBJECTIVE (S):

The objectives of this course are to:

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

## COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	1 to 3, 12	1,3
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	1 to 4 ,12	2
CO3	Understand the role of a human being in ensuring harmony in society and nature.	1 to 5,12	2
CO4	Demonstrate the role of human being in the abatement of pollution	1 to 5,12	2,3
CO5	Describe appropriate technologies for the safety and security of the society as responsible human being.	1 to 5,12	2,3
CO6	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment	1 to 5,12	2,3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY:

#### Unit – 1

**Introduction and Value Education** – Value Education, process for Value Education, Self-Exploration—what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

## UNIT – 2

**Understanding Harmony in the Human Being** - Harmony in Myself - Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

## UNIT – 3

**Understanding Harmony in the Family, Society and nature** - Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha )- from family to world family!. Understanding Harmony in the Nature and Existence - Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

## UNIT – 4

**Implications of the above Holistic Understanding of Harmony on Professional Ethics** - Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

## TEXT BOOKS

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

## REFERENCE BOOKS

1. Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997
2. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Jalandhar, 1970
3. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993
4. E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2010
5. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd., 2011.

Course Title	Indian Constitution				Course Type		Theory	
Course Code	B22LSM301	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>28</b>	<b>-</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

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

## COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain basic knowledge required to understand Constitution of India.
2. Describe the Fundamental Rights, Duties and other Rights.

## COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.	1, 6, 7, 8, 9, 12	1, 3
CO2	Demonstrate the practicality of Constitution perspective and make them face the world as a bonafide citizen.	1 to 4, 7, 8, 12	2

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT



**THEORY:****UNIT – 1**

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

**UNIT – 2**

**Human Rights:** Nature and Scope of human rights, Universal protection of human rights (UDHR), Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups (children, women & old-age).

Human values: Truth, Honesty, Loyalty, Love, Peace with examples, Difference between ethics, beliefs and morals.

**TEXT BOOKS:**

1. Kapoor, S.K., "Human rights under International Law and Indian Law", Prentice Hall of India, New Delhi, 2002.
2. Basu, D.D., "Indian Constitution", Oxford University Press, New Delhi, 2002.

**REFERENCES BOOKS:**

1. Meron Theodor, "Human Rights and International Law Legal Policy Issues", Vol. 1 and 2, Oxford University, Press, New Delhi, 2000.
2. M V Pylee, "An Introduction to Constitution of India", S Chand & Company, 5<sup>th</sup> Edition
3. Durga Das Basu, "Introduction to constitution of India", LexisNexis, 23<sup>rd</sup> Edition.

Course Title	Environmental Science				Course Type		Theory	
Course Code	B22AS0304	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>28</b>	<b>-</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

This course intends to understand, analyze and execute the environmental conditions and the control measures on various types of pollutions can be recognized. This course also talks about the environmental degradation on global warming, acid rain formation, and waste management and how the energy and natural resources can be used effectively in ecosystem.

## COURSE OBJECTIVE (S):

The objectives of this course are to:

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

## COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	Pos	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	1-5	2
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products.	1-5	3
CO3	Classify different wastes, sources of waste and their effect on population	1-5	2,3
CO4	Demonstrate various water conservation methods and suggest appropriate technique for conservation of water	1-5	2,3
CO5	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	2,3,4	3
CO6	Analyse the ecological imbalances and provide recommendations to protect the environment.	1-5	3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1									3	3
CO4	1	1	3	2	5									3	3
CO5		2	2	2											3
CO6	1	2	2	2	2										3

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

## COURSE CONTENT

### THEORY:

#### UNIT – 1

##### ENVIRONMENT & ENVIRONMENTAL PROTECTION:

**Basics of environment:** Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

**Environmental protection:** Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations, Initiative and Role of Non-government organizations in India and world.

*Self study:* Need for public awareness on the environment, Gaia Hypothesis

#### UNIT – 2

##### Environmental pollution, degradation & Waste management:

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

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

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

*Self study:* Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes, Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

### UNIT – 3

**Energy & Natural resources:**

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

**Natural resources:**

Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance.

Mineral resources - Types of minerals, Methods of mining & impacts of mining activities. Forest wealth - Importance, Deforestation-Causes, effects and controlling measures

*Self study:* Hydrology & modern methods adopted for mining activities, Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.

### UNIT – 4

**Ecology, ecosystem & field work:**

**Ecology**-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem - Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-a biotic and biotic, biological diversity.

Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

**Field work:**

Visit to waste water treatment and biogas plant at REVA university campus, and/or Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

*Self study:* Need for balanced ecosystem and restoration of degraded ecosystems.

### TEXT BOOKS:

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

### REFERENCE BOOKS:

1. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, New Delhi, 3<sup>rd</sup> Edition, 2016
2. Anil Kumar Dey and Arnab Kumar Dey, "Environmental Studies", New age international private limited publishers, New Delhi, 2<sup>nd</sup> Edition, 2007
3. Michael Allaby, "Basics of environmental Science", Routledge-Taylor & Francis e-library, New York, 2<sup>nd</sup> Edition, 2002
4. Dr.Y.K Singh, "Environmental Science", New age international private limited publishers, New Delhi, 1<sup>st</sup> Edition, 2006.

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

## COURSE OVERVIEW

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

## COURSE OBJECTIVE(S):

The objectives of this course are to:

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

## COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
<b>CO1</b>	Make use of ARM processor instruction set for developing simple assembly programs.	1,2,7,12	1
<b>CO2</b>	Interpret the functional architecture of computing systems.	1,2,4,10	1
<b>CO3</b>	Identify the issue related to instruction set architecture, memory unit and control unit and I/O functions.	1,11	1
<b>CO4</b>	Develop a real world application using parallel processing concepts.	1,2,4,10,11	1,2
<b>CO5</b>	Learn new tools and technologies and apply for suitable application development.	12	1
<b>CO6</b>	Develop solutions in the Computer Architecture and Organization to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 6, 10	1, 2

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Arithmetic unit:** Addition and Subtraction of Signed Numbers, Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations, Arithmetic operations on floating point numbers.

#### UNIT – 2

**Introduction to ARM processor:** Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer and Internet of Things (IoT). ARM characteristics, Register structure, Addressing modes, Instructions, Assembly language, Operating Modes and Exceptions, Conditional execution of Instructions.

#### UNIT – 3

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

## UNIT – 4

**Input/output Organization:** Bus structure, Bus operation, Arbitration, Interface circuits, Intercommunication standards.

**Parallel processing:** Hardware multithreading, Vector (SIMD) processing and Shared Memory multiprocessors.

### TEXTBOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Mcgrahill.

### REFERENCEBOOKS:

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

### JOURNALS/MAGAZINES

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

### SWAYAM/NPTEL/MOOCs:

1. <https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs25/preview](https://onlinecourses.nptel.ac.in/noc20_cs25/preview)
3. <https://www.edx.org/course/computation-structures-2-computer-architecture-2>

### Self-Learning Exercises:

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

Course Title	Design and Analysis of Algorithm				Course Type	Theory		
Course Code	B22CI0402	Credits	3		Class	IV Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>-</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

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

## COURSE OBJECTIVE (S):

The objectives of this course are to:

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

## COURSE OUTCOMES (COs):

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

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



**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

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

**COURSE ARTICULATION MATRIX**

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

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

**COURSE CONTENT****THEORY:**

<b>UNIT – 1</b>
<b>Introduction</b> -Notion of an Algorithm; Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms.
<b>UNIT – 2</b>
<b>Brute Force:</b> Bubble Sort, Selection Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search, Divide-and-Conquer: Merge sort, Quick sort, Multiplication of Large Integers, Decrease-and-Conquer- Insertion Sort, Topological Sorting.
<b>UNIT – 3</b>
<b>Greedy Technique</b> -Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm Dynamic Programming- Fibonacci numbers, Binomial coefficient, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms
<b>UNIT – 4</b>
<b>Space and Time Trade-Offs</b> - Sorting by Counting, Input Enhancement in String Matching,, Coping with the Limitations of Algorithm Power- Backtracking-n-Queens Problem, Subset-Sum Problem, Branch-and-Bound, Assignment Problem, Travelling Salesman Problem

**TEXTBOOKS:**

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

#### **REFERENCEBOOKS:**

- 1.Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", PHI, 3rd Edition,
2. ACM Transactions on Algorithms.
- 3.ACM Journal of Algorithms and Computational Technology.

#### **JOURNALS/MAGAZINES**

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

#### **SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.swayam2.ac.in/cec20\\_cs03/preview](https://onlinecourses.swayam2.ac.in/cec20_cs03/preview)
2. <https://iiier.org/NPTEL-Local-Chapter>
3. <https://www.edx.org/course/algorithm-design-and-analysis>

#### **Self-Learning Exercises:**

1. More exploration on GitHub

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

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1,to 5,12	1,2
CO5	Learn new tools and technologies in DBMS and apply for suitable application development.	12	1
CO6	Develop solutions and create better database, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

**COURSE ARTICULATION MATRIX:**

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

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

**COURSE CONTENT  
THEORY:**
**UNIT – 1**

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

**UNIT – 2**

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

**UNIT – 3**

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

**UNIT – 4**

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

**TEXTBOOKS:**

1. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education, 5th Edition, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill, 3rd Edition, 2003.
3. Phill Pratt, "Concepts of Database Management, Cengage Learning", 8<sup>th</sup> Edition, 2014
4. Jeffrey A Hoffer, "Modern Database Management, Pearson", 12<sup>th</sup> Edition, 2015

**REFERENCE BOOKS:**

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

**JOURNALS/MAGAZINES**

1. <http://www.ijstr.org/final-print/june2019/Database-Management-System.pdf>
2. <https://www.dbjournal.ro/>

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.coursera.org/courses?query=database%20management>
2. [https://onlinecourses.swayam2.ac.in/cec19\\_cs05/preview](https://onlinecourses.swayam2.ac.in/cec19_cs05/preview)
3. <https://www.edx.org/learn/databases>
4. <https://www.classcentral.com/course/swayam-data-base-management-system-9914>

**Self-Learning Exercises:**

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

Course Title	Programming with JAVA				Course Type	Theory		
Course Code	B20CI0302	Credits	3		Class	IV Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>42</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.
5. Discuss object-oriented features and advance Java programming skills
6. Explain to create robust object-oriented applications with Java.

### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2
CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

## COURSE ARTICULATION MATRIX

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

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

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Fundamental Programming Structures:** Dissecting the “Hello, World” Program; Compiling and Running a Java Program; Primitive Types; Variables; Arithmetic Operations; Strings; Input and Output; Control Flow; Arrays; Functional Decomposition.

#### UNIT – 2

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

### UNIT – 3

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

### UNIT – 4

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

#### TEXT BOOKS:

1. Cay S. Horstmann, "Core Java® SE 9 for the Impatient", Addison Wesley, Second Edition, 2018.
2. Herbert Schildt, "Java™: The Complete Reference", McGraw-Hill, Tenth Edition, 2018.
3. David Gallardo, Ed Burnette, Robert McGovern, "Eclipse in Action a guide for java developers", Manning Publications, 2003.
4. Ed Burnette, "Eclipse IDE Pocket Guide: Using the Full-Featured IDE", O'Reilly Media, Inc, USA, 2005.

#### REFERENCE BOOKS:

1. Cay S. Horstmann, "Core Java™ Volume I—Fundamentals", Prentice Hall, Tenth Edition, 2015
2. Joshua Bloch, "Effective Java", Addison-Wesley Professional, Third Edition, 2017
3. Ken Kousen, "Modern Java Recipes", O'Reilly Media, Inc., 2017
4. Oracle Java Documentation. (<https://docs.oracle.com/javase/tutorial/>)

#### JOURNALS/MAGAZINES

1. <https://ieeexplore.ieee.org/document/5464387>
2. <https://files.eric.ed.gov/fulltext/EJ1075126.pdf>
3. <https://www.sciencedirect.com/science/article/pii/S0167642304000590>
4. <https://www.informingscience.org/Publications/4322?Source=%2FJournals%2FJITEIP%2FArticles%3FVolume%3D0-0>
5. <https://www.javadevjournal.com/>
6. <https://blogs.oracle.com/javamagazine/>

#### SWAYAM/NPTEL/MOOCs:

1. [https://onlinecourses.nptel.ac.in/noc19\\_cs84/preview](https://onlinecourses.nptel.ac.in/noc19_cs84/preview)
2. <https://www.classcentral.com/course/swayam-programming-in-java-12930>
3. <https://swayam.gov.in/explorer?searchText=java>

#### Self-Learning Exercises:

1. The Eclipse-IDE
2. Streams
3. Concurrent Programming
4. Swing and JavaFX
5. Networking- JDBC, Database Access



Course Title	Design and Analysis of Algorithms Lab				Course Type		Lab	
Course Code	B22CI0405	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

#### COURSE OVERVIEW

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

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

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

#### COURSE OUTCOMES (COs):

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

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

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

#### COURSE ARTICULATION MATRIX

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

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

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

Course Title	Database Management System Lab				Course Type	Lab		
Course Code	B22CI0406	Credits	1		Class	IV semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				
					0	28	25	25

#### COURSE OVERVIEW:

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

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

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

#### COURSE OUTCOMES(COs):

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

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1,to 5,12	1,2
CO5	Learn new tools and technologies in DBMS and apply for suitable application development.	12	1
CO6	Develop solutions and create better database, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

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

**COURSE ARTICULATION MATRIX:**

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

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

**PRACTICE:**

S.No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part-A</b>			
1	<p>Consider the following schema for Order Database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)</p> <p>ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>Count the customers with grades above Bangalore's average.</li> <li>Find the name and numbers of all salesmen who had more than one customer.</li> <li>List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)</li> <li>Create a view that finds the salesman who has the customer with the highest order of a day.</li> <li>Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted</li> </ol>	SQL PLUS	Solving queries using SQL
2	<p>Specify the following queries on the Flight relational database schema using SQL</p> <p>Flights(<u>fno</u>: integer, from: string, to: string, distance: integer, departs: time, arrives: time)</p> <p>Aircraft(<u>aid</u>: integer, aname: string, cruisingrange: integer)</p> <p>Certified(<u>eid</u>: integer, aid: integer)</p> <p>Employees(<u>eid</u>: integer, ename: string, salary: integer)</p> <ol style="list-style-type: none"> <li>Find the eids of pilots certified for some Boeing aircraft.</li> <li>Find the names of pilots certified for some Boeing aircraft.</li> <li>Find the aids of all aircraft that can be used on non-stop flights from Bonn to Madras.</li> <li>Identify the flights that can be piloted by every pilot whose salary is more than \$100,000.</li> <li>Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.</li> </ol>	SQL PLUS	Solving queries using SQL

3	<p>Solve the below queries by using SQL</p> <p>Student(snum, sname, major, level, age)</p> <p>Class(cname, meets at, room, fid)</p> <p>Enrolled(snum, cname)</p> <p>Faculty(fid, fname, deptid)</p> <p>The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.</p> <p>Queries</p> <ol style="list-style-type: none"> <li>1. Find the names of all juniors (Level = JR) who are enrolled in a class taught by I. Teacher.</li> <li>2. Find the age of the oldest student who is either a History major or is enrolled in a course taught by I. Teacher.</li> <li>3. Find the names of all classes that either meet in room R128 or have five or more students enrolled.</li> <li>4. Find the names of all students who are enrolled in two classes that meet at the same time.</li> <li>5. Find the names of faculty members who teach in every room in which some class is taught.</li> <li>6. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.</li> <li>7. Print the Level and the average age of students for that Level, for each Level.</li> <li>8. Print the Level and the average age of students for that Level, for all Levels except JR.</li> <li>9. Find the names of students who are enrolled in the maximum number of classes.</li> <li>10. Find the names of students who are not enrolled in any class.</li> </ol>	SQL PLUS	Solving queries using SQL
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4	<p>Solve the below queries by using SQL</p> <p>branch (<u>branch-name</u>, branch-city, assets)</p> <p>customer (<u>customer-name</u>, customer-street, customer-city)</p> <p>account (<u>account-number</u>, branch-name, balance)</p> <p>loan (<u>loan-number</u>, branch-name, amount)</p> <p>depositor (<u>customer-name</u>, <u>account-number</u>)</p> <p>borrower (<u>customer-name</u>, <u>loan-number</u>)</p> <p>employee (<u>employee-name</u>, <u>branch-name</u>, salary)</p> <ol style="list-style-type: none"> <li>Find the names of all customers.</li> <li>Find the names of all branches in the loan relation, don't display duplicates.</li> <li>Display the entire Branch table.</li> <li>Find the account number for all accounts where the balance is greater than \$700.</li> <li>Find the account number and balance for all accounts from Brighton where the balance is greater than \$800.</li> <li>Display the branch name and assets from all branches in thousands of dollars and rename the assets column to 'assets in thousands'.</li> <li>Find the name of all branches with assets between one and four million dollars.</li> <li>Find the name, account number, and balance of all customers who have an account.</li> <li>Find the name, account number, and balance of all customers who have an account with a balance of \$400 or less.</li> </ol>	SQL PLUS	Solving queries using SQL
5	<p>Consider the following schema for a Library Database:</p> <p>BOOK (Book_id, Title, Publisher_Name, Pub_Year)</p> <p>BOOK_AUTHORS (Book_id, Author_Name)</p> <p>PUBLISHER (Name, Address, Phone)</p> <p>BOOK_COPIES (Book_id, Branch_id, No-of_Copies)</p> <p>BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)</p> <p>LIBRARY_BRANCH (Branch_id, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.</li> <li>Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017</li> <li>Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</li> <li>Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.</li> <li>Create a view of all books and its number of copies that are currently available in the Library.</li> </ol>	SQL PLUS	Solving queries using SQL

Course Title	Programming with JAVA Lab				Course Type		Lab	
Course Code	B22CI0407	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	28	25	25

### COURSE OVERVIEW

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

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.
5. Discuss object-oriented features and advance Java programming skills
6. Explain to create robust object-oriented applications with Java.

### COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2
CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

# BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

# COURSE ARTICULATION MATRIX

CO#/ POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO1	3	3	2	2	1								3		
CO2	3	3	2	2	1								3		
CO3	3	3	1	1	1									3	3
CO4	3	3	3	1	2							1		3	
CO5	3	3	3	1	2								3		
CO6	3	3	2	2	2									3	3

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



**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part-A</b>			
1.	The sieve of Eratosthenes is one of the most efficient ways to find all primes smaller than n when n is smaller than 10 million. Given a number n, use JAVA to print all primes smaller than or equal to n.	Windows/Linux OS, IDE	Understanding conditional operators and statements
2.	The Gauss-Jordan method is also known as Gauss-Jordan elimination method is very useful in solving a linear system of equations. It is a technique in which a system of linear equations is resolved by the means of matrices. Develop a JAVA program to solve a given set of linear equations.	Windows/Linux OS, IDE	Creating an array and performing some operations on array.
3.	To compute a square root of any positive number a, start with an initial guess $x=x_1$ for $\forall a$ ; then calculate successive approximations $x_2, x_3, \dots, \forall a$ using the formula: $x_i = \frac{x_{i-1} + (a/x_{i-1})}{2}, i = 2, 3, \dots$ <p>Develop a JAVA application that implements the above SQRT function to compute the square root of any positive</p>	Windows/Linux OS, IDE	Understanding conditional statements (if, if..else, etc)
4.	Model a lamp as a Java object. Make a Lamp class. This will contain atleast one instance variable which will be of type Boolean and will hold the state of the lamp: i.e., whether it is on or off. In addition, add methods to do the following things: switch the light on and off, and check its current state, i.e., whether it is on or off. Maintain proper encapsulation mechanism. <p>Next, write a launcher class with a main() method to carry out the following tasks:</p> <ul style="list-style-type: none"> <li>• create a lamp object;</li> <li>• turn it on and off;</li> <li>• print the lamp's on/off status to the console.</li> </ul>	Windows/Linux OS, IDE	Object and class creation and its usage
5.	Given the following functional interface: <pre>interface MathOperation {     int operation(int a, int b); }</pre> <p>Develop an application that would implement the above interface using lambda expressions as to perform the</p>	Windows/Linux OS, IDE	Creation of interfaces and its usage.

6.	String class in JAVA has a static method compare To Ignore Case, which compares two strings and the Arrays class has a static sort method. Build a JAVA program that creates an array of strings, use the sort function from Arrays class to sort the strings by passing the compare To Ignore Case function as a parameter to the sort function using method reference. Print the sorted array.	Windows/Linux OS, IDE	Creation of string class and its usage
7	technologies is firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize its payroll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. Income Tax is 40% of gross salary for all employees. The annual increments to the employees are to be given of the following criteria: -Manager 10% of the basic salary, and Technicians 15% of basic. Develop the pay roll for XYZ. Implement a class hierarchy using inheritance, where Employee is an abstract class and Manager and Technician are derived from Employee. Demonstrate a polymorphic behavior for giving the annual	Windows/Linux OS, IDE	Creation multiple inheritance and its usage
8	ne a new Exception class named Odd Exception. Create a new class named Even Odd. Write a method called halfOf(), which takes an int as parameter and throws an Odd Exception if the int is odd or zero, otherwise returns (int / 2). Write a main method that calls halfOf() three times (once each with an even int, an odd int, and zero), with three try/catch blocks, and prints either the output of halfOf() or the caught Odd Exception.	Windows/Linux OS, IDE	Creation of exception class and its usage
9	Implement a class named Fraction that represents fractions with numerator and denominator always stored reduced to lowest terms. If fraction is negative, the numerator will always be negative, and all operations leave results stored in lowest terms. Implement the addition, subtraction, multiplication and division operation for the Fraction class and also handle divide by zero using java exception handling mechanism.	Windows/Linux OS, IDE	Creation of exception class and its usage

10	Write a class Student that has instance variables as Name, Age, Address and access transmutation methods to access the instance variables along with display method to print the details of student. Next write a main() function that will create a collection of 10 students and reverse the list. Print	Windows/Linux OS, IDE	Object and class creation and its usage
11	Use generics to build a class Sort. Implement the bubble sort algorithm to sort an array of any type.	Windows/Linux OS, IDE	Creation of generics class and its usage
12	Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).	Windows/Linux OS, IDE	Creation of generics class and its usage

Sl. No.	Part B Mini Project
1	<p>Develop a project for Airline reservation system List with the following modules:</p> <ol style="list-style-type: none"> <li>PASSENGER <ol style="list-style-type: none"> <li>Add member</li> <li>Delete member</li> <li>Search for member</li> <li>Edit member</li> </ol> </li> <li>FLIGHT <ol style="list-style-type: none"> <li>Add Flight</li> <li>Delete Flight</li> <li>Search Flight</li> <li>Display Flights</li> </ol> </li> <li>RESERVATION <ol style="list-style-type: none"> <li>Book</li> <li>Cancel</li> </ol> </li> </ol> <p>Title: Airline Reservation system  Problem Definition:  <i>"Airline Reservation System"</i> main aim is to provide the online ticket &amp; seat reservation of National and International Flights and give the information about flight departures.  Solution:  Develop a project to implement an Airline reservation system with the following modules:</p> <ol style="list-style-type: none"> <li>PASSENGER <ol style="list-style-type: none"> <li>Add member</li> <li>Delete member</li> <li>Search for member</li> <li>Edit member</li> </ol> </li> <li>FLIGHT <ol style="list-style-type: none"> <li>Add Flight</li> <li>Delete Flight</li> <li>Search Flight</li> <li>Display Flights</li> </ol> </li> <li>RESERVATION <ol style="list-style-type: none"> <li>Book</li> <li>Cancel</li> </ol> </li> </ol>
<b>List of Experiments:</b>	
Sl.No	Name of the Experiment
1	Create a passenger class with the attributes Adhar_number, Passenger_name, Email_id, Phone, Address, DOB and the methods to facilitate Addition, Deletion, Search and Modify the passenger data. Store the details of the 10 passenger objects in "Passenger.txt" and Display.

	<ul style="list-style-type: none"> <li>a. void Add_passenger()</li> <li>b. Display_details()</li> <li>c. void Delete_Passenger(Adhar_number)</li> <li>d. void Search_Passenger(Adhar_number)</li> <li>e. void Modify_Passenger(Adhar_number)</li> </ul>
2	It is required to delete an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be deleted and delete the record from "passenger.txt" if found. Otherwise display an error message saying that "record does not exist". Develop a program to implement the above task.
3	It is required to modify an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be modified and modify the record from "passenger .txt" if found. Otherwise display an error message saying that "Record does not exist". Develop a program to implement the above task.
4	It is required to Search an existing passenger data based on the request from the passenger. Read Adhaar card number of the passenger to be searched for, search the record from "passenger .txt" and display the details of passenger if found. Otherwise display the error message "Record does not exist". Develop a program to implement the above task.
5	Create a Flight class with attributes Flight_number, Flight_name, Source, Destination, Departure_Timing and the methods Add_Flight(), Delete_Flight(), Search_Flight() and Display_Flight(). Store the details of any 5 Flights in a file called "Flights.txt" and display the same. Develop a program to achieve the above task.
6	It is required to delete the details a flight stored in "Flights.txt". Read the Flight_no and search for the same in "Flights.txt". If found, it should be deleted from "Flights.txt". Otherwise display the error message "Flight Does Not Exist". Develop a program to achieve the above task.
7	It is required to delete the search for a flight stored in "Flights.txt". Read the Flight_no and search for the same in "Flights.txt". If found, Display the details of Fllight, otherwise display the error message "Flight Does Not Exist". Develop a program to achieve the above task.
8	It is required to display the details of all the flights running from Source1 to Destination1. Read the name of source1 and destination1 and fetch from "Flights.txt" the details of all the flights running between Source1 and desitnation1 and display the same. Develop a program to achieve the above task.
9	<p>Create a reservation class that facilitates booking and cancellation of domestic and international flights using the following methods and parameters. Develop a program to store the details of 10 bookings in "<b>Reservations.txt</b>" and display the same.</p> <ul style="list-style-type: none"> <li>a. Book_Ticket(Flight_Number, Flight_Name, Ticket_Number,Source, Destination, Adhar_number, Passport_number,Date, Departure_time, Class, Type_of_Travel(Domestic , International), Fare, Status)</li> <li>b. Cancel_Ticket(Ticket_Number)</li> </ul>
10	A passenger would like to cancel the ticket due to a genuine reason. Read the ticket_no and search for the record in "Reservation.txt". Cancel the Ticket based on the request from passenger and update the status.