REVA
UNIVERSITY
Bengaluru, India

SCHOOL OF MECHANICAL ENGINEERING

B.Tech

in

Mechatronics

Engineering

HAND BOOK

2022-26

SCHOOL OF MECHANICAL ENGINEERING

HANDBOOK

B. Tech. in Mechatronics Engineering

2022 Scheme

Rukmini Knowledge Park,

Kattigenahalli, Yelahanka, Bangalore - 560 064

Phone No: +91-080-66226622, Fax: 080-28478539

Rukmini Educational
Charitable Trust

www.reva.edu.in

Chancellor's Message

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

- Nelson Mandela.

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

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

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

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

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

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

Vice-Chancellor's Message

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

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

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

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from

various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

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

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

Welcome to the portals of REVA University!

Dr. M. Dhanamjaya
Vice-Chancellor, REVA University

Director's Message

With great pleasure, I welcome you to the School of Mechanical Engineering at REVA University. The School offers Undergraduate programs in Mechanical Engineering and Mechatronics Engineering leading to B. Tech. Degree, in addition to Master's Program leading to M. Tech. Degree in Machine Design. More than 1500 students representing various parts of India as well a few students from overseas study at our School. The School has more than 60 well qualified and experienced faculty members. The School has modern teaching, learning, innovation and research facilities, in addition to excellent facilities for recreation and sports. Students are encouraged to live on campus to have better campus experience and our hostel facilities are second to none.

We understand that the students come to university for learning and the School focuses on enhancing the efficiency of learning of students and also achieving the learning outcomes to pursue careers in modern day industries. To improve efficiency of learning the School has successfully adopted modern day pedagogical methods like project based learning, problem based learning, blended learning, flipped class rooms, experiential learning and created digital resources for students to access and experience. The faculty members of the School continuously upgrade their pedagogical methods and knowledge to be in par with the best in the Country. Our students are very successful in developing and demonstrating technologically advanced projects during their final year.

Our masters and PhD Scholars work on scientifically and technologically advanced topics in mechanical design, engineering analysis, manufacturing of mechanical and mechatronic systems and publish their research findings in international journals of repute.

The School has created an excellent ambience conducive for innovation, creativity and interaction. Faculty mentors and senior students instill confidence in the junior students and motivate them to achieve higher goals. The students are given support for their industry internship, placements, study abroad, industry projects and interaction with industry mentors.

I welcome you to our School and I am sure your learning experience at our school will be an enjoying and memorable one.

Dr. K.S. Narayanaswamy
Director

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RUKMINI EDUCATIONAL CHARITABLE TRUST

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

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

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

ABOUT REVA UNIVERSITY

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

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

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

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

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit

System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor 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, Fluid Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety

of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

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

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

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

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO,

Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

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

Vision

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

Mission

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

Objectives

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

ABOUT SCHOOL OF MECHANICAL ENGINEERING

Mechanical Engineering is one of the oldest and classical branches of engineering which drives the development and economy of the country .The school of Mechanical Engineering in REVA University has a rich blend of experienced, energetic and dedicated faculty with highest qualification in the specialization of thermal, design, manufacturing and management streams. The school is having well-furnished class rooms and well equipped laboratories with modern software tools to meet academic and industry requirements. The research Centre with modern equipment's and testing facility is also available to cater research activities in the field of materials and bio-fuels. The school is conducting extracurricular and co-curricular activities to develop additional skills, knowledge and confidence through University Industry Interaction Cell and various student clubs and student chapters with the support of industries. Industry persons are invited to give technical talks on latest technologies and students are deputed for internship in industries and universities in India and Abroad. The school is having   MOU with reputed industries and universities in India and abroad for internship, research and twinning program or higher studies which will give more exposure of our students to outside world. Many students have done internship in reputed institutions like IISc, ISRO, DRDO, HAL, Rail Wheel factory, Volvo and many more. Every semester school is organizing industry visits to reputed institutions to learn various aspects of industry. The school is having clubs and chapters which are MARS, ISHRAE Student Chapter, Foundry man Society, Fluid Power Society, Solar Society, Tribology society, Robotics club, SAE club and Aryan Racing Team through which cultural events, training programs, invited talks, industry visits and placement activities are conducting. School is encouraging the students to participate in national and international level competitions like solar car design, Electric vehicle design, Formula car design, ATV design, Go-Cart design and quiz competition through this student can learn additional skills like design, team management, time management and financial aspects. Additional training programs are conducting in the field of automobile, robotics, and manufacturing to impart skills with industry relevant. The School is organizing workshops, seminars, conferences and competitions in national and international level for the students, faculty and research scholars to enhance their skills and research trends. The school offers B.Tech in Mechanical Engineering, B.Tech in Mechatronics Engineering, M.Tech in Machine design and PhD program. The curriculum of both UG and PG is designed to meet the needs of the society and industry for present and future. It also meets the requirements of higher studies in India and abroad and also for the requirement of competitive exams. In overall, school will support and make our students more disciplined, good human being and more responsible persons of the society.

Vision

"Aspires to be recognized globally for outstanding value based education in mechanical and allied areas and research leading to well-qualified engineers, who are innovative, entrepreneurial, successful in their career and committed to the development of the country."

Mission

- To impart quality education to the students and enhance their skills to make them globally competitive engineers in mechanical and allied areas.
- To promote multidisciplinary study, cutting edge research and expand the frontiers of engineers' profession in mechanical and allied areas.
- To create state-of-art facilities with advanced technology for providing students and faculty with opportunities for innovation, application and dissemination of knowledge.
- To prepare for critical uncertainties ahead for mechanical engineering and allied areas and to face the challenges through clean, green and healthy solution.
- To collaborate with industries, institutions and such other agencies nationally and internationally to undertake exchange programs, research, consultancy and to facilitate students and faculty with greater opportunities for individual and societal growth.

ADVISORY BOARD

Sl. No.	Details of Members
1	**Dr. N. V. Ravikumar,** Associate Professor, Department of Metallurgy & Materials Engineering, IIT Madras, Chennai.
2	**Mr. K. N. Narsimha Murthy** Chairman, Fluid Air Systems, Bengaluru. Hon. Treasurer, Karnataka Small Scale Industries Association (KSSIA)
3	**Prof. M. V. Krishna Murthy** Former Professor, Dept. Mechanical Engineering, IIT Madras, Chennai, Former Director, VIT, Vellore.
4	**Mr. Praveen Kumar Jinde,** Scientist, NAL, Bengaluru.
5	**Dr. K Ramachandra** Former Director, GTRE, Bangalore CEO, NP-MICAV's National Design Research Forum The Institute of Engineers, Bengaluru.
6	**Prof. E. Abhilash** Dept. Mechanical Engineering, King Khalid University Abha, Kingdom of Saudi Arabia.

Programme Overview

Mechatronics Engineering is a multidisciplinary branch of engineering that focuses on mechanical, electronics and electrical systems and also includes a combination of robotics, computer, telecommunication and product engineering.

There is an immense scope for mechatronics engineering in the present scenario due to fast growth in automation and advancement in technology. The main advantage after the completion of this programme is that one can not only work in the field of mechatronics, but has equal opportunities in the other stream of engineering such as mechanical, electronics, electrical, computer and information technology. Mechatronics engineering has application in areas like Transportation and Vehicle Systems, Telecommunication and Data Communication Networks, Power Devices, Medical/Bio medical systems, Heavy Engineering and Manufacturing Systems, Energy Devices, Consumer Products, Computer Techniques in Medical, Bio imaging and Technology Systems and Computer Integrated Manufacturing Devices and Systems.

This program is developed in direct response to industrial demand for engineers with multi-disciplinary skills. The program allows engineers to design, construct and run factory production lines and automated processes, where they use acquired knowledge in computers and programming, micro-controllers, programmable logic controllers, industrial sensors, hydraulic system, pneumatic system and electric drives.

The School of Mechanical Engineering at REVA University offers B. Tech program in Mechatronics Engineering to prepare innovative, creative and thinking graduates to fill the roles of mechatronics engineers who can conceptualize, modelling and develop mechanical and electrical systems to meet the modern day requirements.

The curriculum of this program is outcome based and it comprises theoretical concepts and practical skills in the domain. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. Along with above mentioned features, the advanced teaching and learning resources, and experienced faculty members with their strong connections with manufacturing sector makes this program unique.

The curriculum covers major topics such as robotics and vision systems, data acquisition systems, sensors and transducers, rapid prototyping, computer integrated manufacturing, industrial robotics, internet of things (IoT), managerial and economical aspects. This curriculum meets requirement of industry, research

and development and competitive exams like GATE, IAS and IES etc. By studying the mechatronics programme the students have the opportunity to appear for GATE in the stream of Electronics Engineering or Mechanical Engineering.

Our strongest conviction is that *'Interdisciplinary courses of Mechanical domain and Electronics domain are the hardcore of this program* to create Industry ready and skill-oriented living engineers.

Program Educational Objectives (PEO's)

After few years of graduation, the graduates of B.Tech. Mechatronics Engineering will:

- **PEO 1:** Work as an Engineer in mechanical and electronics sectors in multidisciplinary role

- **PEO 2:** Act as an administrator in public, private and government organisations or start own business with further training and education.

- **PEO 3:** Pursue higher education to work in colleges, universities as professors or as scientists in research establishments.

- **PEO 4:** Adopt lifelong learning philosophy for continuous improvement in working environment either as a member of team or lead the team.

Program Outcomes (POs)

On successful completion of the program, the graduates of B.Tech. Mechatronics Engineering will be able to:

- **PO 1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, to solve problems in mechatronics engineering.

- **PO 2: Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

- **PO 3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate 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 and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems

- **PO 5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling 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 diverse teams, and in multidisciplinary settings.

- **PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

Program Specific Outcomes (PSOs)

On successful completion of the program, the graduates of B.Tech. Mechatronics Engineering will be able to:

- **PSO 1:** Apply mechatronics engineering knowledge and skills in Design, Manufacturing, Automation and Electronics to obtain realistic outcomes.

- **PSO 2:** Identify, formulate, analyze and solve problems in mechatronics engineering and allied domains.

- **PSO 3:** Conduct investigations in Mechanical and Electronics Engineering and allied areas to provide optimal and sustainable solutions.

REVA University Academic Regulations

B. Tech., 4 years Degree Programs

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

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

1.   Title and Commencement:

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

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

2.   The Programs:

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

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

3.   Duration and Medium of Instructions:

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

3.2   The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both and project, listed under a program; Example: "Fluid Mechanics" in B. Tech Civil Engineering program, "Engineering Thermodynamics" in B. Tech., Mechanical program are examples of courses to be studied under respective programs.
Every course offered will have three components associated with the teaching-learning process of the course, namely: L, T and P, where,

L stands for **Lecture** session consisting of classroom instruction.
T stands for **Tutorial** session consisting participatory discussion/self-study/desk work/brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the lecture classes.
P stands for **Practice** session and it consists of hands-on experience such as laboratory experiments, field studies, case studies, project based learning or course end projects and self-study courses that equip students to acquire the required skill component.

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

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

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

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

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

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

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

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

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

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

5.   Eligibility for Admission:

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

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

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

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

6.   Courses of Study and Credits

6.1   Each course of study is assigned with certain credit value

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

6.3   The credit hours defined as below:

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

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

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

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

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

7.   Different Courses of Study:

Different **Courses of Study** are labeled as follows:
   a. Core Course (CC)

   b. Foundation Course (FC)

   c. Hard Core Course (HC)

   d. Soft Core Course (SC)

   e. Open Elective Course (OE)

   f. Skill Development Course (SDC)

   g. Mandatory Non Credit Course (MC)

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

8.   Credits and Credit Distribution

8.1   A candidate has to earn 168 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

8.3   Foundation Course (FC), Hard Core (HC) or Soft Core (SC), Open Elective (OE) Skill Development Course (SDC).

8.4   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.

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

8.5 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.

8.6 **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.

8.7 **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**.**

8.7.1 **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.**

> ➤ 1st test is conducted for 20 marks during **8th week** of the Semester;

> ➤ 2nd test is conducted for 20 marks during **15th week** of the of the Semester;

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

> ➤ Question paper of the **1st test should be based on first 50% of the total syllabus**;

> ➤ Question paper of the **2nd test should be based on remaining 50 % of the total syllabus**;

> ➤ An assignment must be designed to cover the entire syllabus

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

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

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

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

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

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

9.12   Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should

be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.

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

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

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

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

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

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

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

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

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

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

9.23   Online courses may be offered as per UGC norms.

For online course assessment guidelines would be as follows:

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

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

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

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

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

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

4 week online course – 1 credit

8 week online course / MOOC – 2 credits

12 week online course / MOOC – 3 credits

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

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Scaled down to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	40	20	9th week
2	Test -2	During 15th Week	Remaining 50%	40	20	16th Week
3	Assignment / Quiz - 1	Every week till Test-1	First 50%	10	05	9th Week
4	Assignment / Quiz - 2	Every week during Test-1 and Test-2	Remaining 50%	10	05	16th Week
5	SEE	18th to 20th Week	100%	100	50	20th Week

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

Summary of Internal Assessment and Evaluation Schedule

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

10   Assessment of Students Performance in Practical Courses

Lab courses are of two types: integrated labs and separate labs.
The performance in the practice tasks / experiments shall be assessed on the basis of:

        a.   Knowledge of relevant processes;

        b.   Skills and operations involved;

        c.   Results / products including calculation and reporting

10.1   Assessment of lab courses

10.1.1 Assessment of Separate lab course

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

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

10.1.2 Assessment of integrated lab course

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

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

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

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

Note: No Separate SEE for integrated lab course

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

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

For >= 2 credit courses

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

For 1 credit courses

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

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

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

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

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

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

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

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

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

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

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

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

Illustration for Computation of SGPA and CGPA

Illustration No. 1

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

Thus, **SGPA = 159 ÷ 19 = 8.37**

Illustration No. 2

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

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

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

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

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

Illustration:
CGPA after Final Semester

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

Thus,

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

c. Conversion of grades into percentage:

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

Illustration: CGPA Earned 8.02 x 10=80.2

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

Classification of Results

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

CGPA	Grade (Numerical Index) G	Letter Grade	Performance	FGP Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	Distinction
7 >= CGPA < 8	8	A	Very Good	First Class

6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

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

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

14.2 Attendance Requirement

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

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

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

15. Re-Registration and Re-Admission:

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

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

16. Absence during Internal Test:

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

teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. **Provision for Appeal**

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

i. **Grievance Committee:**

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

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

- The Controller of Examinations - Ex-officio Chairman / Convener

- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.

- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

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

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

19. **Provision for Supplementary Examination**

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

given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

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

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

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

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

Case 3:   A students who has failed in a maximum of 12 credits from semester 1 to 6 together shall move to the 7th semester of the succeeding year.

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

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

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

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

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

B.Tech in Mechatronics Engineering

Curriculum Structure for B. Tech Mechatronics Engineering Program

SEMESTER-1 (Cycle-1)

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	B22AS0102	Differential Equations and Linear Algebra	FC	3	0	0	3	3	50	50	100	BSC
2	B22AS0107	Applied Physics	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 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	B22CS0108	Data Science Lab	HC	0	0	1	1	2	25	25	50	ESC
9	B22EE0102	Basics of Electrical and Electronics Engineering Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22AS0108	Applied Physics Lab	FC	0	0	1	1	2	25	25	50	BSC
		TOTAL		**17**	**0**	**4**	**21**	**25**	**400**	**400**	**800**	
		TOTAL SEMESTER CREDITS		**21**								
		TOTAL CUMULATIVE CREDITS		**21**								
		TOTAL CONTACT HOURS		**25**								
		TOTAL MARKS		**800**								

Nomenclature: **L:** 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 branch

SEMESTER-2 (Cycle-2)

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	B22AS0202	Vector Calculus and Partial Differential Equations	FC	3	0	0	3	3	50	50	100	BSC
2	B22AS0204	Applied 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	B22CI0108	Programming with C Lab	HC	0	0	1	1	2	25	25	50	ESC
9	B22ME0104	Engineering Workshop	HC	0	0	1	1	2	25	25	50	ESC
10	B22AS0206	Applied Chemistry Lab	FC	0	0	1	1	2	25	25	50	BSC
11	B22ER0201	Skill Development Course	SDC	0	0	2	2	4	50	50	100	ESC
12	B22AS0208	Tree Plantation in Tropical Region: Benefits and Strategic Planning	FC	1	0	0	1	1	25	25	50	HSMC
			TOTAL	15	0	8	23	31	475	470	950	
		TOTAL SEMESTER CREDITS		23								
		TOTAL CUMULATIVE CREDITS		44								
		TOTAL CONTACT HOURS		30								
		TOTAL MARKS		950								

SEMESTER-3

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	B22AS0302	Laplace Transforms and Fourier Series	HC	3	1	0	4	5	50	50	100	BSC
2	B22AH0301	Professional Ethics	FC	2	0	0	2	2	50	50	100	HSMC
3	B22ME0301	Entrepreneurship	FC	1	0	0	1	1	25	25	50	HSMC
4	B22AS0304	Environmental Science	MC	0	0	0	0	2	0	50	50	BSC
5	B22ES0301	Thermal Engineering	HC	2	1	0	3	4	50	50	100	PCC
6	B22ES0302	Signals and Networks	HC	3	0	0	3	3	50	50	100	PCC
7	B22ES0303	Analog and Digital Circuits	HC	3	0	0	3	3	50	50	100	PCC
8	B22ER0304	Mechanical Measurements and Metrology	HC	2	0	1	3	4	50	50	100	PCC
9	B22ER0305	Mechanics of Solids	HC	3	0	0	3	3	50	50	100	PCC
10	B22ES0304	Analog and Digital Circuits Lab	HC	0	0	1	1	2	25	25	50	PCC
11	B22ER0307	Material Testing Lab	HC	0	0	1	1	2	25	25	50	PCC
12	B22ES0305	Soft Skill -1	HC	0	0	1	1	2	25	25	50	PCC
			TOTAL	19	2	4	25	33	450	500	950	
		TOTAL SEMESTER CREDITS						25				
		TOTAL CUMULATIVE CREDITS						69				
		TOTAL CONTACT HOURS						33				
		TOTAL MARKS						950				

SEMESTER-4

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	B22AS0403	Probability and Sampling Theory	HC	3	1	0	4	5	50	50	100	BSC
2	B22AH0302	Universal Human Values	FC	2	0	0	2	2	50	50	100	HSMC
3	B22ER0401	Technical Documentation	FC	1	0	0	1	1	25	25	50	HSMC
4	B22LSM301	Indian Constitution	MC	0	0	0	0	2	0	50	50	HSMC
5	B22ER0503	Kinematics and Dynamics of Machines	HC	1	1	0	2	3	50	50	100	PCC
6	B22ES0401	Microcontrollers and Applications	HC	3	0	0	3	3	50	50	100	PCC
7	B22ES0402	Sensors and Actuators	HC	3	0	0	3	3	50	50	100	PCC
8	B22ES0403	MATLAB for Mechatronics	HC	0	0	1	1	2	25	25	50	PCC
9	B22ES0404	Microcontrollers and Applications Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B22ER0508	Kinematics and Dynamics Lab	HC	0	0	1	1	2	25	25	50	PCC
11	B22ES0405	Skill Development Course	SDC	0	0	2	2	4	50	50	100	PCC
12	B22ES0406	Soft Skill -2	HC	0	0	1	1	2	25	25	50	PCC
		TOTAL		13	2	6	21	31	425	575	900	
		TOTAL SEMESTER CREDITS		21								
		TOTAL CUMULATIVE CREDITS		90								
		TOTAL CONTACT HOURS		31								
		TOTAL MARKS		900								

SEMESTER-5

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	B22MEO501	Smart Materials	OE	3	0	0	3	3	50	50	100	OE
2	B22PAM501	Indian Heritage and Culture	MC	0	0	0	0	2	0	50	50	HSMC
3	B22ES0501	Electrical Machines and Drives	HC	3	0	0	3	3	50	50	100	PCC
4	B22ER0302	Material Science	HC	3	0	0	3	3	50	50	100	PCC
5	B22ES0502	Control Systems	HC	2	1	0	3	4	50	50	100	PCC
6	B22ES0503	Robotics	HC	3	0	0	3	3	50	50	100	PCC
7	B22ESS511	CNC Machines	SC	3	0	0	3	3	50	50	100	PEC
	B22ESS512	Conventional and Electrical Vehicles										
	B22ESS513	Product Design and Development										
	B22ESS514	Data Structures										
8	B22ES0504	Skill Development Course	SDC	0	0	2	2	4	50	50	100	PCC
9	B22ES0505	Control Systems Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B22ES0506	Robotics Lab	HC	0	0	1	1	2	25	25	50	PCC
			TOTAL	17	1	4	22	29	400	450	850	
		TOTAL SEMESTER CREDITS		22								
		TOTAL CUMULATIVE CREDITS		112								
		TOTAL CONTACT HOURS		29								
		TOTAL MARKS		850								

45

SEMESTER-6

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	B22MEO601	Energy Technology	OE	3	0	0	3	3	50	50	100	OE
2	B22ES0601	Automation in Production	HC	3	0	0	3	3	50	50	100	PCC
3	B22ES0602	Introduction to Finite Element Methods	HC	2	1	0	3	4	50	50	100	PCC
4	B22ES0603	Optimization Methods	HC	3	0	0	3	3	50	50	100	PCC
5	B22ESS611	Robotic Dynamics and Control	SC	3	0	0	3	3	50	50	100	PEC
	B22ESS612	Hybrid Vehicles										
	B22ESS613	Digital Manufacturing systems										
	B22ESS614	Computer Vision										
6	B22ESS621	Autotronics and Vehicle Automation	SC	3	0	0	3	3	50	50	100	PEC
	B22ESS622	Aircraft Flight and Control System										
	B22ESS623	Operation Management										
	B22ESS624	Machine Learning with Python										
7	B22ES0604	Automation Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B22ES0605	Computer Aided Engineering Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B22ES0606	Research Based Mini Project	HC	0	0	2	2	4	25	25	50	PROJ
			TOTAL	**17**	**1**	**4**	**22**	**27**	**375**	**375**	**750**	
			TOTAL SEMESTER CREDITS	**22**								
			TOTAL CUMULATIVE CREDITS	**134**								
			TOTAL CONTACT HOURS	**27**								
			TOTAL MARKS	**750**								

SEMESTER-7

Sl. No	Course Code	Title of the Course	HC / FC /SC /OE /MC	L	T	P	Total Credit	Contact Hours / Week	CIE Marks	SEE Marks	Total Marks	Course category (As per AICTE)
1	B22MEO701	Electric and Hybrid Vehicles	OE	3	0	0	3	3	50	50	100	OE
2	B22MEO702	Total Quality Management and Six Sigma	OE	3	0	0	3	3	50	50	100	OE
3	B22ES0701	Design of Machine Elements	HC	2	1	0	3	4	50	50	100	PCC
4	B22ES0702	Introduction to Hydraulics and Pneumatics	HC	3	0	0	3	3	50	50	100	PCC
5	B22ES0703	Digital Signal Processing	HC	3	0	0	3	3	50	50	100	PCC
6	B22ESS711	Additive Manufacturing	SC	3	0	0	3	3	50	50	100	PEC
	B22ESS712	Smart Materials										
	B22ESS713	Engineering Economics and Financial Management										
	B22ESS714	Internship										
7	B22ESS721	IoT and Cyber Physical Systems	SC	3	0	0	3	3	50	50	100	PEC
	B22ESS722	Agriculture Automation and Smart Farming										
	B22ESS723	Micro and Nano Mechatronics Systems										
	B22ESS724	Artificial Intelligence										
8	B22ES0704	Hydraulics and Pneumatics Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B22ES0705	Digital Signal Processing Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B22ES0706	Project Phase-1	HC	0	0	1	1	3	25	25	50	PROJ
		TOTAL		**20**	**1**	**3**	**24**	**29**	**425**	**425**	**850**	
TOTAL SEMESTER CREDITS				**24**								
TOTAL CUMULATIVE CREDITS				**158**								
TOTAL CONTACT HOURS				**29**								
TOTAL MARKS				**850**								

SEMESTER-8

| 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	B22ES0801	Major Project	HC	0	0	10	10	20	50	50	100	PROJ
			TOTAL	0	0	10	10	20	50	50	100	

TOTAL SEMESTER CREDITS	10
TOTAL CUMULATIVE CREDITS	168
TOTAL CONTACT HOURS	20
TOTAL MARKS	100

Detailed Syllabus
Semester - 1

Course Title	Differential Equations and Linear Algebra				Course Type		FC	
Course Code	B22AS0103	Credits	3		Class		I 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	IA	SEE
	Tutorial	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW

This course is introduction to applied mathematics, which is useful for Mechanical engineering students. This course covers identifying and methods of solving differential equation of first and higher order along with applications to engineering problems. Most importantly learn linear algebra topics like linear transformation, solving linear system of equations and determining Eigen values and Eigen vectors.

COURSE OBJECTIVES

1. Solve the first order ordinary differential equations and its applications in the field of engineering.
2. Solve the higher order linear differential with constant coefficients
3. Solve the higher order linear differential equations with variable coefficients and its applications in the field of engineering.
4. Apply Different methods to solve consistent system of algebraic equations.
5. Solve the Eigen values and Eigen vectors of a square matrix
6. Diagonalization of a square matrix and canonical forms

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Solve first order ordinary differential equations and its application using different methods.	1,2,4	1
CO2	Solve Non-Homogeneous Linear Differential Equations with constant coefficients using direct method and the method of variation of parameters	1,2,4	1
CO3	Solve Non-Homogeneous Linear Differential Equations with variable coefficients	1,2,4	1
CO4	Compute the solution of system of equations by various methods	1,2,4	1
CO5	Compute the Eigen values and Eigen vectors of square matrix and to diagonalize the square matrices.	1,2,4	1
CO6	Apply the linear transformation and canonical form of matrix in Mechanical Engineering	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									3		
C04	3	3		1									3		
CO5	3	3		1									3		
C06	3	3		1									3		
Average	3.0	3		1									3		

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

COURSE CONTENT

Unit – 1

Differential equations of First order and first degree:
(Recap: Variable separable, Homogenous and Linear equations) Bernoulli's equation, Exact Differential Equations, Equation reducible to exact [IF for the case of $\frac{1}{M}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ and $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ $only$].Orthogonal trajectories (both Cartesian and polar form), Engineering applications.

Unit – 2

Linear differential equations:
Linear differential equations with constant coefficients: inverse differential operator method and method of variation of parameters. Linear differential equations with variable coefficients: Solution of Cauchy's and Legendre's linear differential equations, engineering applications.

Unit – 3

Linear Algebra:
Rank of Matrix by elementary transformations, Linear System of Equations, Conditions of Existence and Uniqueness of Solutions. Solution of linear system of equations by Gauss Elimination, Gauss –Jordan and Gauss-Seidel method, Engineering applications.

Unit – 4

Matrix theory:
Eigen Values and Eigen Vectors, Rayleigh's power method to find the largest Eigen value and the corresponding Eigen vector. Linear transformation, diagonalization of a square matrix. Reduction of Quadratic form to Canonical form, engineering applications.

TEXT BOOKS
1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Reprint edition, 2013
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015

REFERENCE BOOKS
1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2013
2. P.V. O'Neil, "Advanced Engineering Mathematics", Thomson Mathematical Methods by Potter & Goldberg; Publisher: PHI.

JOURNALS / MAGAZINES
1. https://www.journals.elsevier.com/journal-of-differential-equations
2. https://www.journals.elsevier.com/linear-algebra-and-its-applications

SWAYAM/NPTEL/MOOCs
1. https://nptel.ac.in/courses/111/106/111106051/
2. https://nptel.ac.in/courses/111/104/111104031/
3. https://www.coursera.org/learn/differential-equations-engineers

Course Title	Applied Physics			Course Type		FC	
Course Code	B22AS0107	Credits	3	Class		I 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	IA	SEE
	Tutorial	0	0	0				
	Total	3	3	3	42	0	50 %	50 %

COURSE OVERVIEW

Applied 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 basic concepts of Physics and its applications to Civil and Mechanical Engineering courses by emphasizing the concepts underlying four units .1 Kinematics & Rectilinear motion, 2. Lasers and optics and its applications 3. Physical and mechanical Properties of Materials, 4. Measurements and measuring instruments. This subject has basic laws, expressions and theories which helps to increase the scientific knowledge to analyze upcoming technologies. The course also consists of real time and numerical examples which makes subject interesting and attractive.

COURSE OBJECTIVES

This course enables graduating students

1. To understand the basic concepts and principles of Physics to analyze practical engineering problems and apply its solutions effectively and efficiently.
2. To Understand the Concepts of Kinematics of rectilinear and curvilinear motion.
3. To understand the characteristics, working, principle and applications of Lasers.
4. To gain the knowledge of different optical phenomena and its applications in Interference, diffraction and Polarization.
4. To understand the physical and mechanical properties of materials.
5. To recognize the measurements and their accuracy.
6. To understand design issues, practical oriented skills and problem solving challenges.

COURSEOUTCOMES (Cos)

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

CO	Course Outcomes	POs	PSOs
CO1	Explain the Concepts of Kinematics of rectilinear and curvilinear motion.	1,2	1,2,3
CO2	Explain the working, principle and applications CO2 and semiconductor lasers and also characteristics of lasers and applications.	1,2	1,2,3
CO3	Explain the phenomena of interference in thin films.	1	1,2,3
C04	Analyze the different physical and mechanical properties of materials.	1,2	1,2,3
CO5	Explain the construction and working of different of measuring instruments and Strength of Materials.	1,2	1,2,3
C06	Determine the accuracy of mechanical instruments.	1,2,7	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				✓		
CO2				✓		
CO3			✓			
C04				✓		
CO5				✓		
C06				✓		

COURSE ARTICULATIONMATRIX

CO/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2											1	1	1
CO2	3	2											2	2	1
CO3	3	2											1	1	1
C04	3	2											1	1	1
CO5	3	2											2	1	1
C06	3	2					1						1	2	1
Average	3	2.					1						1.3	1.3	1

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

COURSE CONTENT

Unit-1

Kinematics and Rectilinear Motion: Principles of dynamics, differential equation of rectilinear motion, D'Alemberts principle, Momentum and Impulse, Work and Energy, Impact.

Curvilinear Translation: Kinematics of Curvilinear motion, differential equations of curvilinear motion, motion of projectile, D'Alemberts principles in curvilinear motion, work and energy in curvilinear motion.

Unit-2

Lasers: Lasers Interaction between radiation and matter, Expression for energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser operation, Requisites of laser system, Construction and working of Carbon Dioxide (CO_2) laser, Semiconductor (GaAs) laser and Applications of laser-Cutting, drilling ,welding and LIDAR..

Optics: Principle of Superposition, Interference of light, Interference in thin films by reflection, determination of the wavelength of a given monochromatic light and refractive index of a liquid – Applications of Interference TIR-Optical fiber. Diffraction – Fraunhofer diffraction due to single slit, double slit and Diffraction grating (qualitative). Polarization – Polarization by double refraction – Nicol's Prism – Applications of Polarization.

Unit-3

Physical Properties of Materials: Density, Specific gravity, State Change temperatures, Coefficients of thermal expansion ,Specific Heat, Latent heat, Fluidity, Weld ability, Elasticity ,Plasticity ,Porosity, Thermal conductivity Electrical Conductivity.

Mechanical Properties Of Materials: Stress and Strain, Tensile strength, Stress-Strain- behavior, Ductile and Brittle Materials, Impact test, Toughness, Hardness test, Fatigue and fatigue test, Creep and Creep test, Fracture

Unit-4

Measurements and Measuring instruments: Introduction, Definition, Requirement of measurements, significance of measurement system, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers. Mechanical members: Bourdon tube, Diaphragm, Bellows. Electrical members: Resistive, capacitive, piezoelectric transducers. Intermediate Modifying and Terminating Devices: Introduction, Mechanical systems, inherent problems, electrical intermediate modifying devices, Introduction to Terminating devices, Meter indicators, CRO, Measurement of frequency.

TEXT BOOKS

1. M.N. Avadhanulu and P.G. Kshirsagar , "A Text book of Engineering Physics", S. Chand & Company Ltd, 10th Revised Edition, New Delhi.
2. Gaur and Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Revised Edition 2017.

REFERENCE BOOKS

1. Resnick, Halliday and Jearl Walker, "Fundamentals of Physics", John Wiley & Sons, Inc., 11th Edition, 2018.
2. William Smith, "Foundations of Materials Science and Engineering", McGraw-Hill Science Engineering Math.
3. Beckwith Marangoni and Lienhard, "Mechanical Measurements", Pearson Education, 6th Edition, 2006.
4. R.K. Jain,"Mechanical Measurements", Khanna Publishers, 1994.
5. Anand. K. Bewoor and VinayA Kulkarni," Mechanical Measurements and Metrology", McGraw-Hill Science.
6. M.S.Vijaya, G.Rangarajan, "Material Science", Tata McGraw Hill.
7. S.Timoshenko, D.H.Young and J.V.RAo, "Engineering Mechanics", McGraw Hill.

Self-study: Units ,measurements and conversion, Introduction, The international system of units, Measurement of length , Measurement of mass , Measurement of time , Accuracy, precision of instruments and errors in measurement , Significant figures , Dimensions of physical quantities , Dimensional formulae and dimensional equations , Dimensional analysis and its applications, Conversion of CGS system into MKS and SI system.

Course Title	Introduction to Accounting			Course Type		FC	
Course Code	B22EN0102	Credits		1	Class		I Semester
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	1	1	14	0	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

1. To educate students about the accounting principles and practices.
2. To orient about accounting recording and identification of income, expenses, Assets and Liabilities.
3. To get detailed knowledge of the practice of accounting in different forms of business
4. To 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. To 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
CO5	Describe, explain, and integrate fundamental concepts underlying accounting and finance management.	1,2,4,11	1
CO6	Explain the need for the bank reconciliation statement and cash balance.	1,2,4,11	1

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

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

Unit-1

Introduction to Accounting and 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 and 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", Pearson Education, 20th Edition, 2016
2. S.N. Maheshwari, and. S. K. Maheshwari, "Financial Accounting", Vikas Publishing House, New Delhi, 5th Edition, 2012.
3. Dr. Jawaharlal, "Accounting Theory and Practices", HPH, 4th Edition, 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		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	2	2	2	28	0	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

The objectives of this course is 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.

COURSEOUTCOMES (Cos)

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

CO	Course Outcomes	POs	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real-world applications.	1 to 4, 12	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5,12	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1, 2, 3

CO4	Create the real-world AI based solutions using different machine learning algorithms	1 to 6, 12	1, 2, 3
CO5	Find modeling Error in Linear Regression	1 to 5	1, 2, 3
C06	Use statistical principles to solve mean and standard deviations for given data.	1 to 4, 12	1,2, 3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2			✓			
CO3				✓		
C04						✓
CO5		✓				
C06			✓			

COURSE ARTICULATIONMATRIX

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
C04	3	3	3	2	2	2						2	3	3	3
CO5	2	3	2	2	2								3	3	3
C06	3	3	2	2								2	3	3	3
Average	**2.5**	**2.8**	**2.3**	**1.8**	**2.0**	**2.0**						**2.0**	**3.0**	**2.5**	**2.5**

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

COURSE CONTENT

Unit-1

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

Unit-2

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

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

Unit-3

Data science components: Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Description of linear regression and Logistic

Regression. Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.

<div align="center">Unit-4</div>

Data visualization using scatter plots, charts, graphs, histograms and maps: Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data.

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

TEXT BOOKS
1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", McGraw Hill Publications, 3rd Edition 2003.
3. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company, 2004**.**
4. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th Edition, 2013.

REFERENCE BOOKS
1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Edition, 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
3. International Journal on Data Science and Analytics
4. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253
5. IEEE Magazine on Big data and Analytics

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

SELF-LEARNING EXERCISES
1. Relational database management system.
2. Advanced MS-Excel

Course Title	Basic Electrical and Electronics Engineering				Course Type		HC	
Course Code	B22EE0101	Credits	3		Class		I 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	IA	SEE
	Tutorial	0	0	0				
	Total	**3**	**3**	**3**	**39**	**0**	**50 %**	**50 %**

COURSE OVERVIEW
Basic Electrical and Electronics Engineering course 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

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.

COURSEOUTCOMES (Cos)

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

CO	Course Outcomes	POs	PSOs
CO1	Summarize the basics of electrical engineering terminology and the usage.	1,2	1
CO2	Apply KCL and KVL to Solve Electrical Circuits	1,2,4	1
CO3	Demonstrate the working principle of DC Machines and Transformers and provide applications of DC Machines, Transformers.	1,2,4	1
C04	Analyze the characteristics of PN junction diode, Zener diode and their application	1-2,4	1
CO5	Analyze the working principle and characteristics in three configurations of BJT	1-2	1
C06	Apply the concept of Number system and Arithmetic operations in digital system	1-2	1

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2				✓		
CO3				✓		
C04				✓		
CO5			✓			
C06				✓		

COURSE ARTICULATIONMATRIX

CO/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											1		
CO2	3	3		2									1		
CO3	3	2		2									1		
C04	3	3		2									1		
CO5	3	2											3		
C06	3	2											3		
Average	3	13		2									1.7		

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

COURSE CONTENT

Unit-1

Introduction to Electrical Engineering:

Basics of DC Circuits: Ohms law, Kirchhoff's Current Law, Kirchhoff's Voltage law, Numerical examples as applicable

Basics of AC Circuits: Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation, RL, RC and RLC series and parallel circuits, power factor, phasor diagrams, three phase AC –types of three phase connection (star and delta), Comparison between single phase and three phase AC, Numerical examples as applicable

Unit-2

Magnetic Circuits, Motors and Transformers: Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance, Energy and power DC Generator, DC Motors, Transformers - Principle of operation, Construction and EMF equations, types and applications, Numerical examples as applicable

Unit-3

Semiconductor Diodes and Transistors: 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.

Bipolar Junction Transistors (BJT) Configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.

Unit-4

Digital Electronics and Number System: Introduction, Switching and Logic Levels, Digital Waveform.

Number Systems and its conversions: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem.

Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions.

TEXT BOOKS

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

REFERENCE BOOKS

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Edition, 2007.
2. Hughes, "Electrical Technology", Pearson, 9th Edition, 2005.

Self-Learning Exercises

1. Build a electrical circuit using BJT as a switch
2. Identifying the practical application of Electromagnetic Induction

Course Title	Elements of Civil Engineering and Mechanics				Course Type		HC	
Course Code	B22ED0101	Credits	3		Class		I 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	IA	SEE
	Tutorial	0	0	0				
	Total	3	3	3	42	0	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 OBJECTIVES

This course enables graduating students
1. To understand a broad concept of Engineering Mechanics.
2. To enable students to apply fundamentals and basic concepts of Rigid body Mechanics to solve problems of bodies in rest.
3. To enable the students to apply conditions of static equilibrium to analyze physical system of coplanar forces.
4. To analyze the civil engineering structures namely determinate beams and trusses.
5. To provide an overview of centroid and moment of inertia of plane area
6. To understand the concept of Beams and Friction in Civil Engineering

COURSEOUTCOMES (Cos)

After the completion of the course, the student 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	1, 2
CO2	Compute the resultant of system of forces in plane and space acting on bodies.	1,2,5	1, 2
CO3	Analyze civil Engineering Structures using static equilibrium conditions.	1,2,5	1, 2
C04	Compute the reactions developed at the supports of beams and member forces of trusses.	1,2,5	1, 2
CO5	Determine the centroid and moment of inertia of different geometrical shapes.	1,2,5	1, 2
C06	Solve the Engineering Problems for Beams in equilibrium condition and Friction	1,2,5	1, 2

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2					✓	
CO3					✓	
C04					✓	
CO5					✓	
C06					✓	

COURSE ARTICULATIONMATRIX

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

CO3	3	3			1								2	2	
C04	3	3			1								2	2	
CO5	3	3			1								2	2	
C06	3	3			1								2	2	
Average	**3**	**3**			**1**								**1.8**	**1.8**	

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

COURSE CONTENT

Unit-1

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

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

Unit-2

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

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

Unit-3

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

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

Unit-4

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

Friction: Types of friction, laws of friction, limiting friction, coefficient of friction concept of static and dynamic friction, numerical problems on impending motion on horizontal and inclined planes along with connected bodies,

TEXT BOOKS

1. T R Jagadeesh, "Elements of Civil Engineering and Engineering Mechanics", Sapna Book House, 1st Edition, 2007.
2. BK Kolhapure, "Elements of Civil Engineering", Eastern Book Promoters, 10th Edition, 2016.
3. M.N. Shesha Prakash and Ganesh.B. Mogaveer, "Elements of Civil Engineering and Engineering Mechanics", PHI Learning, 3rd Revised Edition.
4. R S Khurmi, "Engineering Mechanics" S Chand and Company.

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.

Course Title	Computer Aided Engineering Drawing			Course Type		HC	
Course Code	B22ME0101	Credits	3	Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	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

1. To introduce the concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient.
2. To enable students to learn about the software tool for preparing engineering drawings
3. To teach the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids.
4. To 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

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1			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		
Average	3	1.6	2		2					3			3		

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

COURSE CONTENT
THEORY

<div align="center">Unit-1</div>

Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software.
Points, Line and Plane Surface: Orthographic projection of points in first and third Quadrant only. Orthographic projection of straight lines inclined to both horizontal and vertical planes. Orthographic projection of regular plane surfaces when the surface is inclined to both HP and VP.

<div align="center">Unit-2</div>

Solids: Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.

<div align="center">Unit-3</div>

Sections of solids: Drawing sectional views and true shape of section,
Development of Lateral Surfaces of Solids: Parallel line method for prisms and cylinders, Radial line method for pyramids and cones.

<div align="center">Unit-4</div>

Isometric Projections: Isometric projections of simple and combined solids.

PRACTICE:

Sl. No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analyzing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analyzing 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	Analyzing 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

Sl. No	Practice	Tools and Techniques	Expected Skill /Ability
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analyzing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analyzing and software skill

TEXT BOOKS

1. K S Narayanswamy and Mahesh L, "Engineering Drawing", WILEY Publishers, 1st Edition, 2017.
2. K. R. Gopalakrishna and Dr. M S Reddy, "Engineering Graphics-1", Subhas Publications, 2015.
3. Bhatt N.D., Panchal V.M and Ingle P.R, "Engineering Drawing", Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.

REFERENCE BOOKS

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

SWAYAM/NPTEL/MOOCS

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

Course Title	Data Science Lab				Course Type		HC	
Course Code	B22CS0108	Credits		1	Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	2	-	28	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

The objectives of this course is 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 LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2			1	3	3			3	3	3
CO2	2	2	2	2	2			1	3	3			3	3	3
CO3	3	3	2	2	2			1	3	3			3	3	3
CO4	3	3	3	2	2			1	3	3			3	3	3
CO5	3	3	3	2	2			1	3	3			3	3	3
CO6	3	3	3	2	2			1	3	3			3	3	3
Average	**2.8**	**2.8**	**2.5**	**2.0**	**2.0**			**1.0**	**3.0**	**3.0**			**3.0**	**3.0**	**3.0**

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

List of Experiments-Part-A

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

3	Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.
	  i) Plot a scatter diagram.
	  ii) Determine the regression equation.
	  iii) Plot the regression line (hint: use MS Excel's Add Trend line feature).
	  iv) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
	  v) Compute the coefficient of determination and the coefficient of correlation.
		MS Excel	Perform prediction and visualiza tion of data

Row 4:

Apply multiple linear regression to predict the stock index price which is a dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.

Year	Month	Interest rate	Un employment rate	Stock index price
2022	10	2.75	5.3	1464

(MS Excel — Perform prediction and visualization of data)

Row 5:

Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10,00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for availed of Rs.10, 00,000during 3 years.

Sl.no	A	B
1	Principal	Rs.10,00,000
2	Annual interest rate	5.2%
3	Year of the loan	3
4	Starting payment number	1
5	Ending payment number	36
6	Total interest paid during period	?

(MS Excel — Create Excel data and perform EMI estimator)

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", Khanna Publishers, 43rd Edition, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", McGraw Hill Publications, 3rd Edition 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", Tata McGraw Hill Publications, 19th Edition, 2013.
2. ErwinKreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th Edition, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

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 and Electronics Engineering Lab				Course Type		HC	
Course Code	B22EE0102	**Credits**	1		**Class**		**I Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	**1**	**2**	**2**	**0**	**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

1. To establish a broad concept of various types of electrical apparatus, tools and instrumentation.

2. To provide hands on experience with electrical apparatus and electrical safety norms.

3. To train students to read and understand schematics so as to make electrical connection for different appliances.

4. To train students in collecting and interpreting experimental data.

5. To enhance written skills of students.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Use appropriate electrical tools for electrical connections and repair of electrical equipment's.	1,2,4,5,9,10	1
CO2	Recognize various symbols in a schematic and make connection as per the schematic	1,2,9,10	1
CO3	Systematically follow various safety procedures.	4,5,9,10	1
CO4	Make use of various measuring instruments to collect experimental data	2,4,9,10	1
CO5	Relate experimental results with theoretical analysis.	2,3,9,10	1
CO6	Demonstrate the ability to critically evaluate the performance of electrical appliances.	1,2,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		3	3				3	3			1		
CO2	3	3							3	3			1		
CO3				3	3				3	3			1		
CO4		3		3					3	3			1		
CO5		3	2						3	3					
CO6	3	2							3	3					
Average	**3**	**2.8**	**2**	**3**	**3**				**3**	**3**			**1**		

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

List of Experiments

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability

No.	Experiment	Equipment	Outcome
1.	To verify KCL and KVL	Measuring instruments(Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2.	Testing 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 V-I Characteristics of SCR	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7.	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor of rectifiers
8.	Design of Clippers and clampers with reference voltages	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
9.	Study and analysis of input output characteristic of CE configuration of BJT.	Characteristics of BJT in Common Emitter Configuration	Input & Output Characteristics of BJT
10.	Verification of basic logic gates using discrete components	Trainer kit	Universal gates will be realized using basic gates

Demo:

1. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.

2. To study the Importance and mechanism of MCB.

TEXT BOOKS

1. Nagrath I.J. and D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition 2009.
2. Hayt and Kimberly, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 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 Systems", Pearson, 5th Edition, 2007.
2. Hughes, "Electrical Technology", Pearson, International Students 9th Edition 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	Applied Physics Lab			Course Type		FC	
Course Code	B22AS0108	Credits	1	Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	2	-	28	50 %	50 %

COURSE OBJECTIVES

1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment.
3. Design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology

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 Physics to find the values and compare the results with theoretical calculations.	1, 2, 9,10	1,2,3
CO2	Find the physical properties of given materials.	1,2,9,10	2, 3
CO3	Find the mechanical properties of given materials.	1,2,3,9,10	1, 2, 3
CO4	Usage of different instruments and real time applications in engineering studies.	1,2, 9, 10	1, 2, 3
CO5	Find the errors in the measuring instruments.	1,2,3,9,10	1, 2, 3
CO6	Understand the concept of physical and mechanical properties of a material and its measuring instruments.	1,9,10	1,2, 3

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

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

Average	2.8	2.8	2.5						3	3			3	3	3

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

List of Experiments

Sl. No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Determination of acceleration due to gravity by Bar pendulum.	Metal bar, stop clock	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
2	Determination of Young's Modulus by Single cantilever.	Cantilever set up and stop clock	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the material.
3	Determination of Moment of Inertia and Rigidity Modulus by Static Torsion method.	Torsion set up, metal plates, screw gauge and stop clock	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the material.
4	Determination of Tensile Strength of mild steel.	Steel rod, weights	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the material and compare with standard values.
5	Determination of Viscosity of Liquid by Poiscuille method.	Capillary tube with bottle, stop clock, measuring jar.	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
6	Determination of Metacentric height of floating body.	Metacentric expt set up with fluid chamber	Understand the theory, principle and perform the experiment, determine the value of Metacentric height.
7	Determination of Viscosity of given liquid using falling ball method	Glass tube, fluid, steel balls with different radius, screw gauge	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
8	Determination of surface tension of water by Capillary rise method.	Capillary tube, glass beaker, travelling microscope.	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the fluid and compare with standard values.
9	Study the Characteristics of CE mode Transistor amplifier.	NPN transistor kit, connecting wires	Understand the theory and perform the experiment, collect the data and draw the input, output and transfer characteristics of given transistor.
10	Calibration of Pressure gauges.	Pressure gauges set up	Understand the theory and perform the experiment, collect the data and interpret the results to know the calibration in gauges.

Sl. No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
11	Study the I-V Characteristics of Photodiode.	Photo diode, light source, circuit board and wires	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to know the photo response of a diode.

REFERENCE BOOKS

1. G.L.Souires, "Practical Physics", Cambridge University, UK, 4th Edition, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", Books & Allied Ltd., Calcutta, 2nd Edition, 1990.

SEMESTER-2

Course Title	Vector Calculus and Partial Differential Equations				Course Type		FC	
Course Code	B22AS0205	Credits		3	Class		II 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	IA	SEE
	Tutorial	0	0	0				
	Total	3	3	3	42	0	50 %	50 %

COURSE OVERVIEW

This course is an essential one for civil and mechanical engineering students. This course covers the concept of vector differentiation to understand the flow problems. Further students are able to understand identifying partial differential equations and methods of solving them.

COURSE OBJECTIVES

1 To impart the knowledge of partial differentiation, multiple integrals and beta gamma functions.
2. To impart the knowledge of vector calculus in the field of engineering.
3. To study about vector integration and curvilinear coordinate system.
4. To study various methods to solve partial differential equations.

COURSE OUTCOMES (COs):

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

CO	Course Outcomes	POs	PSOs
CO1	Study the concept of partial differentiation and its application in engineering.	1,2	1
CO2	Solve double and triple integrals over a region and improper integrals using Beta and Gamma function.	1,2	1
CO3	Analyze vector functions and vector differential operators.	1,2	1
CO4	Evaluate line integrals, surface, and volume integrals and to study curvilinear coordinate systems.	1,2	1
CO5	Evaluate the solution of homogeneous and non- homogeneous partial differential equations.	1,2	1
CO6	Solve partial differential equations with one or more independent variables	1,2	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
CO1	3	1											3	
CO2	3	1											3	
CO3	3	1											3	

CO4	3	2										2	
CO5	3	2										2	
CO6	3	2										3	
Average	**3.0**	**1.5**										**2.7**	

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

COURSE CONTENT

Unit-1

Partial Derivatives and Multiple Integrals: Functions of several variables – Partial derivatives, Homogeneous Functions – Euler's theorem, Jacobians. Multiple Integrals – Double integrals – Change of order and change of variables. Triple integrals Illustrative examples for change of order and change of variables. Gamma and Beta functions with simple examples. Engineering applications.

Unit –2

Vector Calculus: Differentiation of Vectors, Curves in space, Velocity and Acceleration, Tangential and normal acceleration, Relative velocity and acceleration, Scalar and vector point functions- Vector operator del. Del applied to scalar point functions – Gradient, Del applied to Vector point function – Divergence and Curl. Engineering applications.

Unit -3

Vector integration: Line integral – Circulation – work, Surface integral – Flux, Green's Theorem in the Plane, Stokes Theorem, Volume Integral, Divergence Theorem, Green's Theorem, Irrotational and Solenoidal Fields, Orthogonal Curvilinear Coordinates. Engineering Applications.

Unit -4

Partial Differential Equations: Formation of partial differential equations, solutions of non-homogeneous PDE by direct integration, Solutions of homogeneous PDE involving derivatives with respect to one independent variable, solution of Lagrange's Linear PDE, Solutions of PDE by product method, Engineering Applications.

TEXT BOOKS

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Reprint edition, 2013.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2013.

REFERENCE BOOKS

1. P.V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7th Edition, 2012.
2. Potter and Goldberg, "Mathematical Methods", Printice Hall of India Pvt. Ltd.

JOURNALS/MAGAZINES

1. https://www.journals.elsevier.com/partial-differential-equations-in-applied-mathematics/
2. https://www.elsevier.com/books/vector-calculus/cox/978-0-08-057295-6

SWAYAM/NPTEL/MOOCs

1. https://www.coursera.org/learn/calculus-and-optimization-for-machine-learning
2. https://www.coursera.org/learn/vector-calculus-engineers.
3. https://www.coursera.org/learn/differential-equations-engineers

Course Title	Applied Chemistry				Course Type		FC	
Course Code	B22AS0204	Credits	3		Class		II 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	IA	SEE
	Tutorial	0	0	0				
	Total	3	3	3	42	0	50 %	50 %

COURSE OVERVIEW

Applied chemistry covers very relevant topics compatible with engineering students and make them aware of importance of various aspects of basic science in engineering. The subject of applied chemistry covers area of water technology, corrosion phenomenon, which is widely an interdisciplinary subject of discussion. Further the course

focus on the corrosion phenomenon, and various methods to control it. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge of corrosion in higher semester. The present applied chemistry course further enlightens 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 OBJECTIVES

 The Applied chemistry course is designed to fulfill the following objective;

1. To impart knowledge about the significance of water chemistry and various methods of water treatment.

2. To provide information on electrochemical concepts of corrosion science and engineering.

3. Highlights on energy storage devices and other renewable energy sources and their applications.

4. Introduction to engineering materials, properties and their applications.

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	List the properties of water and describe various methods employed in water treatment.	1,6	1
CO2	Analyze the metal stability (corrosion resistance) under different environmental conditions.	1,2,7	1
CO3	Identify and compare the materials best suited materials for construction of battery, fuel cells and Photovoltaic Cell.	1,2,3,7	1
CO4	Describe common use of metals and alloys, ceramics, polymers, their composition, properties and engineering applications.	1	1
CO5	Explore the modern materials and their composites for technological applications	1,2,6	1
CO6	Know the importance of advanced materials for electrochemical energy storage, conversion, and environmental remedies.	1, 7	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				1							1	
CO2	2	1					1						1	
CO3	1	2	1				1						1	
CO4	3	2											1	
CO5	2	2				1							1	
CO6	3	2					1						1	
Average	**2.33**	**1.8**	**1**			**1**	**1**						**1.0**	

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

COURSE CONTENT

Unit-1

Water Technology: Sources of water, Impurities of water, Hardness and its determination (EDTA method), Boiler Troubles and their removal, water softening methods -Lime soda (both hot lime and cold lime), Zeolite and Ion exchange, Desalination of water — Electro dialysis & Reverse osmosis method, Chemical analysis of water: chloride and fluoride estimation.

Unit-2

Concepts of Corrosion Science: 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-3

Energy Devices: Introduction to electrochemical cells, Batteries; primary, secondary and reserve batteries, construction and working of $Zn-MnO_2$, lead-acid, Li-ion batteries, Fuel cells; introduction, types, construction and working of PAFC and SOFC, super capacitors, photo voltaic cell

Unit-4

Modern Materials: Composition, Properties, example and applications of polymers, biomaterials, glass, composite materials, nano materials, thin films, liquid crystals.

Metals and Alloys: Stress and strain curve, mechanical properties of iron, Steel, and alloy steels (Nickel, Chromium, Tungsten).

TEXT BOOKS

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

REFERENCE BOOKS

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

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs

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

Self –learning: Boiler corrosion and its treatment, Mechanism of scale formation in boilers, Anodic protection of corrosion control, Synthesis of Silicon and its purification, Role of stress and strain curve in understanding hardness/toughness of materials, mechanical properties of composite materials

Project Based Learning: To enhance the skill set in the integrated course, the students are advised to execute course-based design projects. Some sample projects are given below:

S. No	Suggested Projects
1.	**Chemical analysis of water for its toxic materials**: This can be done for all types of water sources available and can assess to test their drinkable condition
2.	**Estimation of COD level of water**: To test its toxicity level, polluted by organic compounds
3.	**Corrosion studies:** This can be done corrosion immunity of materials in different acids and bases.

	Analysis of scale and sludge: Collect the scale and sludge samples for sample analysis by various analytical technical, following proper protocol
4.	

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

COURSE OVERVIEW

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

COURSE OBJECTIVES

The 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 (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
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

<div align="center">Unit -1</div>

Functional English: Language as a Tool of Communication, - Effective Communication-Modes of Communication-Email communication - Giving Instructions.

<div align="center">Unit -2</div>

Interpersonal Skills: Traits of good Listener types of Listening-- Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends/relatives, - Process descriptions (general/specific).

<div align="center">Unit-3</div>

Multitasking Skills: Types of Speaking- Paralinguistic Features-Types of paragraphs (cause and effect / compare and contrast / narrative / analytical); Report Writing (Feasibility/ Project report - report format – recommendations / suggestions, PPT).

<div align="center">Unit - 4</div>

Persuasive Skills: Reading and Interpretation- SQ3R- Making inference from the reading passage; predicting the content of a reading passage, - Different types of Essay Writing, applying for a job; Writing a cover letter with résumé / CV.

Text Books:
1. Thorpe, Edgar and Showick Thorpe" Objective English", Pearson Education, 2013.
2. Dixson, Robert J. "Everyday Dialogues in English", Prentice Hall India Pvt Ltd., 1988.
3. Turton, Nigel D. "ABC of Common Errors", Mac Millan Publishers, 1995.
4. Ashraf Rizvi, "Effective Technical Communication" ,McGraw-Hill Education (India) Pvt. LTD., New Delhi, 2018.
Reference Books:
1. Bansal, R.K. and J.B. Harrison, "Spoken English", Orient Blackswan, 2013.
2 .Raman, Meenakshi and Sangeeta Sharma, "Technical Communication", Oxford University Press, 2015.
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**		**II 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	IA	SEE
	Tutorial	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**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 OBJECTIVES
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):
After the completion of the course, the student will 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
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2
CO5	Use algorithms and technologies in C Programming for suitable application development	1-5	2
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

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		
CO2	1	3	2	2	2								3		
CO3	2	2	2		1									3	
CO4	3	3	3	1	1									3	
CO5	3	3	3	2	2									3	
CO6	3	3	3	2	2				3					3	
Average	**2.3**	**2.5**	**2.7**	**1.8**	**1.6**				**3.0**				**3.0**	**3.0**	

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

COURSE CONTENT

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: 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 and 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 and D.M. Ritchie, "C Programming Language", Prentice Hall Software Series, 2nd Edition, 2005.
2. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill, 4th Edition, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A Holistic Approach", PHI, 2nd Edition 2008.

REFERENCE BOOKS

1. Balaguruswamy,"Programming in ANSI C", Tata McGraw Hill, 4th Edition 2008.
2. Donald Hearn and Pauline Baker, "Computer Graphics C Version", Pearson Education, 2nd Edition, 2004.

JOURNALS/MAGAZINES

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

SWAYAM/NPTEL/MOOCs

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

SELF-LEARNINGEXERCISES

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

Course Title	Elements of Mechanical Engineering				Course Type		HC	
Course Code	B22ME0103	Credits	3		Class		II 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	IA	SEE
	Tutorial	0	0	0				

		Total	3	3	3	39	0	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

1. To develop the basic knowledge on heat & work, steam formation, working principle of boilers, turbines, IC engines and refrigeration - air conditioning systems
2. To incorporate the concept of different types of machine elements like springs, belt drives & chain drives
3. To give exposure in the field of engineering materials and manufacturing processes
4. To incorporate the concepts of modern manufacturing processes like CNC, 3D printing technology and its applications
5. To 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

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			
CO2	2												1			
CO3	2												1			
CO4	3	1											1	1		
CO5	3	1											1	1		
CO6	1												1			
Average	2.3	1											1	1		

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

COURSE CONTENT

Unit-1
Introduction to Energy Systems: Concept of heat and work, Steam formation, Types of steam, Steam properties, numerical on steam properties, Introduction to boilers, working of Babcock and Wilcox boiler.

Unit-2
Prime Movers: Types and working principle of turbines, IC Engines, numerical on IC engines.
Introduction to Refrigeration and Air Conditioning: Working principle of refrigeration system, working of domestic refrigerator and window air conditioner

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

Unit-4
Machine Elements: Types and applications of springs, belt drives, gear drives and chain drives, numerical on belt drives and gear trains.
Introduction to Mechatronics and Robotics: Need of Mechatronics in industries, measurement system, open and closed loop control system, Robot anatomy, applications of Robotics.

TEXT BOOKS
1. K R Gopala Krishna, Sudheer Gopala Krishna and S C Sharma, "Elements of Mechanical Engineering", Subhash Publishers, 13th Edition, 2015.
2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, 2000.

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

JOURNALS/MAGAZINES
1. International Journal of Machine Tools and Manufacture
2. International Journal of Refrigeration.

SWAYAM/NPTEL/MOOCs:
1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering
2. https://www.my-mooc.com/en/categorie/mechanical-engineering.

Course Title	IoT and Applications				Course Type	HC
Course Code	**B22EN0101**	**Credits**	**2**		**Class**	**II Semester**
Course	LTP	Credits	Contact Hours	Work Load	Total Number of Classes	Assessment

Structure	Lecture	1	1	1	Per Semester		Weightage	
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practical	1	2	2				
	Total	2	3	3	14	28	50	50

COURSE OVERVIEW

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

COURSE OBJECTIVE

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	

CO														
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
Average	2.8	2.0	1.3	1.0	2.0				2.0	2.0	2.0	2.0	2.0	1.8

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

COURSE CONTENT
THEORY

<div align="center">

Unit-1

</div>

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.

<div align="center">

Unit-2

</div>

IoT Enabling Technologies
IoT Development Boards: Arduino, Add-on ESP module, Node MCU, Raspberry Pi; Sensors and Actuators: Temperature Sensor, PIR Sensor, Ultrasonic senor; Communication Technologies: Bluetooth, ZigBee, LoRa, WiFi, **Cellular; Protocols:** HTTP, MQTT, CoAP; IoT Cloud Platforms: Arduino Cloud, Thing Speak, Blink Cloud

PRACTICE:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
	Introduction to Arduino Board & getting stared with Arduino IDE software	Hardware & software	Identifications of various parts of Arduino Board &
1	Write a program to blink an LED a) Infinite number of times with ON & OFF duration of 1 sec b) infinite number of times with ON time duration 2 sec and OFF time duration 0.5 sec c) Only 3 times with ON and OFF duration 2 sec	Arduino UNO, Arduino IDE, LED's	Arduino coding
2	Write a program to blink 4 LED in the given pattern 	Arduino UNO, Arduino IDE, LED's	Arduino coding, Looping structure
3	Write a program to blink an LED with different times and duration using the concept of user defined function	Arduino UNO, Arduino IDE, LED's	Arduino coding, user define function

4	Write a program to interface motion sensor and display its status using g LED. If motion is detected it turn on LED otherwise keeps the turn off the LED.	Arduino UNO, Arduino IDE, LED, PIR sensor	Interface PIR sensor
5	a) Write a program to increase and decrease the brightness of LED. b) Write a program to control the brightness of LED using Potentiometer	Arduino UNO, Arduino IDE, LED, Potentiometer	
6	a) Write a program to interface LDR to Arduino board and display the voltage across LDR on serial monitor b) Write a program to control the brightness of LED based on the intensity of light on LDR	Arduino UNO, Arduino IDE, LED, LDR	Interface LDR sensor
7	a) Write a program to interface temperature sensor and display the values on the serial monitor b) Write a program display range of temperature on LCD	Arduino UNO, Arduino IDE, LCD, Temperature sensor	Interface Temperature sensor
8	Write a program to interface ultrasonic sensor and display the distance from an object.	Arduino UNO, Arduino IDE, Ultrasonic sensor	Interface Ultrasonic sensor
Challenging Experiments			
9	a) Introduction to ESP module & programming using Arduino IDE software b) Write a program to demonstrates how to use Wifi module ESP8266-01 to blink LED (with simple LED)	ESP8266 Arduino Uno, LED, Arduino IDE	Interface of LED to ESP Module, Program ESP using Arduino IDE
10	Write a program to demonstrate how ESP8266 can be used as an HTTP client and HTTP server to control and monitor the status of an LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server Model
11	Write a program demonstrate how ESP8266 can be used as HTTP Webserver and get commands from the client (mobile/Laptop) directly.	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server model, Create Webserver
12	Write a program to demonstrate how to implement Publisher/Subscriber method (MQTT) to control and monitor the ESP8266 GPIO2 LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Publisher/Subscriber Model
13	Write a program to demonstrate how ESP8266 can be used to log sensor data into thinkspeak cloud.	ESP8266, Arduino Uno, LED, Arduino IDE, ThingSpeak Cloud Service	Connect to cloud and storing data.
Part-B (Case Study/ Projects - Sample Topics)			

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

TEXTBOOKS

1. Vijay Madisetti and Arshdeep Bahga , "Internet of Things: A Hands-On- Approach", 2nd Edition ,2014.
REFERENCE BOOKS:
1. Raj Kamal," Internet of Things: Architecture & Design Principle", McGraw Hill Education 2017.
SWAYAM/NPTEL/MOOCs:
1. https://www.coursera.org/learn/iot
2. https://www.coursera.org/learn/interface-with-arduino

Course Title		Design Thinking			Course Type		Hard Core	
Course Code	B22ME0102	Credits	2		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1	Theory	Practice	IA	SEE
	Practice	1	2	2				
	Tutorial	0	0	0				
	Total	2	3	3	14	28	50 %	50 %

COURSE OVERVIEW

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

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

COURSE OBJECTIVES

1. To impart knowledge on design thinking process for understanding designs.
2. To provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. To 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

BLOOM'S LEVEL OF THE COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	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	
Average	1.6	2.3	3		2			1	2.6	2.3		2.2	1.8	2.3	

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

COURSE CONTENT

THEORY

Unit-1

Design Thinking Process:

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

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

<div align="center">

Unit-2

</div>

Defining the problems:

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

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

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

Tutorials:

Sl. No	Name of the Topic	Tools and Techniques	Expected Skill /Ability
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human centered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop making problem statements from user perception
6	Presentation by student teams	PPT	Develop ability to express their views
7	Carry out Brain storming between the groups and generate as many as ideas possible	Ideation tools	Develop innovative mind set
8	Prototype for best 3 ideas selected	Sketching, simple model making etc.	Develop prototyping techniques
9	Presentation by student teams	PPT	Develop ability to express their plan
10	Test the developed prototype with set of identified users	Google forms , cold calls, social media etc.	Develop understanding of various testing methods
11	Pitching final solution	PPT	Develop ability to express their views

TEXT BOOKS:

1. Gavin Ambrose and Paul Harris, "Basics Design-Design Thinking", AVA Publishers, 2010

2. Kathryn McElroy, "Prototyping for Designers: Developing the best Digital and Physical Products", O'Reilly, 2017.

REFERENCE BOOKS:

1. Michael G. Luchs, Scott Swan, Abbie Griffin, "Design Thinking – New Product Essentials from PDMA", Wiley, 2015.

2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", John Wiley & Sons, 2012.

JOURNALS/MAGAZINES/ADDITIONAL SOURCES

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

2. https://www.ideo.com

3. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
4. https://www.ibm.com/design/thinking/page/toolkit
5. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
6. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
7. https://youtu.be/M66ZU2PCIcM
8. https://thisisdesignthinking.net/2017/07/innogy_energy_ecarsharing/

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/109/104/109104109/
2. https://nptel.ac.in/courses/11010612

Course Title	Programming with C Lab				Course Type		HC	
Course Code	B22CI0108	Credits		1	Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	2	0	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 OBJECTIVES

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)

After the completion of the course, the student will 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, 10	2,3

BLOOM'S LEVELOF THE COURSE OUTCOMES

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

COURSE ARTICULATIONMATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3						3	3			3		
CO2	1	3	2	2	2				3	3			3		
CO3	2	2	2		1				3	3				3	3
CO4	3	3	3	1	1				3	3				3	3
CO5	3	3	3	2	2				3	3					
CO6	3	3	3	2	2				3	3			3	3	2
Average	**2.3**	**2.5**	**2.7**	**1.8**	**1.6**				**3.0**	**3.0**			**3.0**	**3.0**	**2.7**

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

PRACTICE

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
PART A:			
1	Consider Loan applications in a bank consisting of various customer details such as Name, Organization, salary and loan amount applied. Segregate the loan applications based on income (low: <=5 lpa, medium: >5lpa <10lpa and high:>10lpa)	Condition checking	Apply if-else and switch
	Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are placed in the third file. Display the contents of DATA.	Files operations	Apply File concepts
2	Statistical measures are used for data analysis and interpretation. Develop program to determine the mean and stand deviation of data stored in an array.	Statistical Computing	Use Array and loops
	Consider the details of Airline passengers such as Name, PAN-No., Mobile-no, Email-id, Source, Destination, Seat-No and Air-Fare. Develop a program to read the details of	Search technique	Apply Structures

	airline passengers, store them in the structure "Airline" and List details of all the passengers who travelled From "Bengaluru to London".		
3	Assume that Mr. Peterson shopped N items at Big Market and his Cart comprises of name of the item, cost of the item per UNIT and quantity. Read the details of shopping and store them in the structure "Shop". Compute the total amount spent on shopping at Big Market and also find out the item with minimum and maximum cost.	Statistical measure	Apply Structure and if then else
	b. Write a C program to define a structure named Student with name and DOB, where DOB in turn is a structure with day, month and year. Read the details of student and store them in the structure "Student". Display name and date of birth of students using the concept of nested structures.	Nested Structures	Apply Nested Structures
4	Consider a set of N students with SRN, name, and marks scored in 8 subjects. Read the details of students and store them in the structure "Student_Marks". Compute total marks and average marks of each student and display them with suitable headings.	Average computation and visualization	Apply Structure, Array and Loops
	b. Create the structure "Book" with book_id, title, author_name and price. Write a C program to pass a structure as a function argument and print the book details.	Functions	Passing structures to function
5	Assume that Ms. Jassica shopped N items at Amazon and the Cart comprises of name of the item, cost of the item per UNIT and quantity. Arrange the items in the increasing order of cost of the item per UNIT.	Sorting	Apply sorting the contents of structure.
6	Write a C program to compute the monthly pay of "N" employees using each employee's name, Basic_Pay, DA and HRA. The DA and HRA are 80% and 30% of the Basic_Pay respectively. Gross-salary is computed by adding DA and HRA to Basic_Pay. Store all the details in an array of structures and print the name and gross salary of each employee.	Reading and storing data	Use structures for reading and storing data
7	Consider the details of "N" Faculty members consisting of Name, EMP-ID,name of the school, address and salary. Create a file to store the above details. Retrieve the contents of the file to perform following operations: (i) Display the details of the faculty based on salary range entered. (ii) Display the details of the faculty based on the EMP-ID entered.	File operations	Create file, store data and display details.
8	Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if else and switch case.	String operations	Apply string functions
PART B:			

	Project 1: Address Contact List with the following modules: User Add User(Name, Address, Primary contact number, secondary contact number, E-mail ID) Delete User Search for User Edit Find and replace the user name Edit the contact (Phone Number) details. Edit the Address of the user Report List of users based on the starting letter of their names. List of users based on first 2 digits of their mobile number. List of users based on the domain name of their E-mail ID.		
1	Develop a program in C to create the structure "Contact" with the fields, user name, address, mobile, phone1 and email_id. Read the data into the structure "Contact" and store them in the file "Contact.txt".	Structures and Files	Develop the program using Structures and Files
2	Develop a program in C to open contact list from the file "Contact.txt" in read mode and delete contact details of the person based on name of the person by searching his/her details. Display the updated list.	String, File and Linear Search	Develop the program using String and File
3	Develop a program in C to input the string,"Str1" (which can be either a mobile no. or name of the user) and search for it in the file, "Contact.txt" and display the details if it is found else display an error.	String, File and Linear Search	Develop the program using String and File
4	Develop a program in C to input the name of the user into the string, "Str1" , search for it in the file "Contact.txt" and replace the content of "Str1" with the new data if found.	String, File and Linear Search	Develop the program using String, File and apply linear search
5	Develop a program in C to input the phone number of user into the string, "Str1", search for it in the file "Contact.txt" and edit it with new data if found and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
6	Develop a program in C to input the address of the user and search for the same in the file, "Contact.txt" and edit the address with new address and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
7	Develop a program in C to input a letter into "Letter", compare it with the details stored in "Contact.txt" and then display the list of the users whose name begin with "Letter ".	File operations	Develop the program using file
8	Develop a program in C to input first two digits of a mobile number into "Mobile", search for the same in "Contact.txt" and display the details of all the users whose mobile number begin with "Mobile".	File operations	Develop the program using file
9	Develop a program in C to input a domain name of email-id and search for the same in the file, "contact.txt" and list the details of the users whose email-id matches with the given domain name.	File operations	Develop the program using file

TEXT BOOKS

1. B.W. Kernighan and D.M. Ritchie, "C Programming Language", Prentice Hall Software Series, 2nd Edition, 2005.

2. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill, 4th Edition, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A Holistic Approach", PHI, 2nd Edition 2008.

REFERENCE BOOKS

1. Balaguruswamy,"Programming in ANSI C", Tata McGraw Hill, 4th Edition 2008.
2. Donald Hearn and Pauline Baker, "Computer Graphics C Version", Pearson Education, 2nd Edition, 2004.

Course Title	Engineering Workshop				Course Type		Hard Core	
Course Code	B22ME0104	Credits		1	Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	2	0	28	50 %	50 %

COURSE OVERVIEW

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

COURSE OBJECTIVES

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

COURSE OUTCOMES (COs)

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

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

BLOOM'S LEVELOF THECOURSE OUTCOMES

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

CO/ POs						
CO1		✓				
CO2		✓				
CO3			✓			
CO4			✓			
CO5			✓			
CO6		✓				

COURSE ARTICULATIONMATRIX

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

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

Part-A

1. Dismantling and Assembly of 2-Wheeler (2–stroke) Engine Parts.

2. Identification of parts of an engine of Toyota Innova and Toyota Fortuner

3. Calculation of Speed ratio of belt, chain and gear drives.

4. Study of Power train of Bicycle, 2-Wheeler and 4-Wheeler.

5. Demonstration of laser engraving process and 3D printing process.

Part-B

1. Study of Fitting tools and preparation of fitting models.

2. Study of sheet metal tools and development of pen stand and funnel

3. Hands on training on welding.

4. Study of power tools.

TEXT BOOKS

1. K.R. Gopalkrishna, "Elements of Mechanical Engineering", Subhash Publishers, 12th Edition, 2012.

2. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, "The Elements of Workshop Technology - Vol I & II", Media Promotors and publisher, 11th Edition, 2001.

REFERENCE BOOKS

1. David A. Crolla, "Automotive Engineering-Powertrain, Chassis System and Vehicle Body", Butterworth-Heinemann is an imprint of Elsevier, 1st Edition, 2009.

2. R.S.Parmar, "Welding Processes and Technology", Khanna Publishers, New Delhi, 2003.

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture

2. https://www.shutterstock.com/search/disassembled-bike-engine

3. https://pdfcoffee.com/ex5-assembly-and-disassembly-of-ic-engine-parts-pdf-free.html

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering

2. https://www.my-mooc.com/en/categorie/mechanical-engineering

Course Title	Applied Chemistry Lab				Course Type		FC	
Course Code	B22AS0206	Credits		1	Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	2	0	28	50 %	50 %

COURSE OVERVIEW

Engineering chemistry LAB covers very relevant experiment which is related to the topics compatible with ME 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 OBJECTIVES

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

1. Provide basic knowledge and experimental required for engineering students to understand its importance of Science in technology.
2. 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.
3. 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.
4. Electrochemical methods will be used to fabricate materials as thin films and various sensing techniques for lab analysis
5. 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.	1,2,9,10	1
CO2	Demonstrate the electrolytic process in electrochemical cell for the purpose of energy storage and energy conversion devices.	1,2,9,10	1
CO3	Describe the corrosion phenomenon and list out various precautions to be taken in the selection of materials in controlling corrosion.	1,2,9,10	1
CO4	Preparation of commercially important polymers, nano materials, composite materials and their applications	1,2,3,9,10	1
CO5	Analyze various water quality parameters in daily life suitable for portability.	1,2,8	1
CO6	Preparation of thin film and bulk solid state conductors and semiconductors relevant to device applications	1,2,3,9,10	1

BLOOM'S LEVELOF THE COURSE OUTCOMES

CO	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create

	(L1)	(L2)	(L3)	(L4)	(L5)	(L6)
CO1			✓			
CO2				✓		
CO3					✓	
CO4		✓				
CO5				✓		
CO6		✓				

COURSE ARTICULATIONMATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							3	3			1		
CO2	2	1							3	3			1		
CO3	1	2							3	3			1		
CO4	2	2	1						3	3			1		
CO5	2	2						1	3	3			1		
CO6	1	2	1						3	3			1		
Average	**1.5**	**1.8**	**1**					**1**	**3**	**3**			**1**		

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

Part-A: List of Experiments

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 and 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 and perform the experiment, Interpret the ionic conductivity in the solution. Measure the conductance of ionically conducting liquid materials
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	DC power supply units, Electrochemical cells, different	Understand the theory of soft electrochemical deposition of thin films

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
	Cu/Ni/Zn on stainless steel.	coating substrate	and perform the experiment on deposition different conductive substrates
6	Determination of Viscosity of organic Liquids by Ostwald's Viscometer	Ostwald Viscometer	Understand the theory of viscosity and perform the experiment to estimate viscosity of different fluids.
7	Evaluation of Dissolved Oxygen by Winkler's method and hence assessment of quality of water.	Winkler's method, Iodometric technique	Understand the theory and perform the experiment, collect the data and interpret dissolved oxygen content in industrial and domestic effluents
8	Estimation of Calcium/Iron/Silica in Portland Cement.	Indicators,	Understand the theory and composition of cement and perform the experiment, to estimate the important constituents of cement
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	Determination of Alkalinity of Water Sample	Different alkaline water, variable composition, Mixed indicators	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 percentage of iron in corrosion products.	Corrosion products, compositions analysis	A better understanding the mechanism of corrosion. Able to perform experiment to estimate the extent of corrosion and quantify the amount of corroded products
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

PART-B: Projects

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Flame photometric determination of metal ions in corroded products, water and engineering materials	Flame Photometer	To demonstrate the extent of metal ions dissolved from the substrate of different engineering materials.
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

REFERENCE BOOKS

1. V R Gowariker, N V Viswanathan and Jayadev Sreedhar, "Polymer Science", Wiley eastern ltd, 4th Edition, 2021.
2. Sudha Rani and S.K. Bashin, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, 3rd Edition, 2012.
3. J. Mendham," Vogel's Quantitative Chemical Analysis", Parsons, 6th Edition, 2009.

JOURNALS/MAGAZINES

1. https://pubs.acs.org/doi/abs/10.1021/acs.jchemed.5b00118
2. https://www.youtube.com/watch?v=7yuXjGdQRzM
3. https://www.youtube.com/watch?v=g5z6EaT46iA
4. https://www.youtube.com/watch?v=-GS6uoFf3qQ

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

COURSE OVERVIEW

This course introduces significance of trees that provide us with a great many ecosystem services, including air quality improvement, energy conservation, storm water 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, clean-up, and removal.

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

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

COURSE OBJECTIVES

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 areas, 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 (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
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						
Average							3		3						

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

COURSE CONTENT

Unit-1

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

Unit-2

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

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.

Additional guidelines for Tree Plantation in Tropical Region: Benefits and Strategic Planning course

Since this course is aimed as a special drive to restore climate change and arresting global warming, following guidelines have been framed to conduct this course as activity-based learning to build greener nation through student community. Successful implementation of this drive meets one of the very important Sustainable

Development Goals (SDG's) of UN Envision 2030 on Climate Change and Global warming. This is also one of the requirements in NEP 2020 and UGC/AICTE.

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