VELS
INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM, THIRUVANMIYUR - CHENNAI

# UNDERGRADUATE DEGREE PROGRAMME

## B.Tech. BIOMEDICAL ENGINEERING

## CURRICULUM & SYLLABUS

## REGULATIONS 2026

**Effective from the Academic Year**
**2026-2027**

## Department of Biomedical Engineering
## School of Engineering

**PALLAVARAM**

| VISION OF THE INSTITUTE |
|---|
| To make the Institute an epitome of excellence in higher education by effectively providing high quality education and rigorous training to students in multiple streams of choice with ample scope for all round development to make them excel in their profession for betterment of the society. |

| MISSION OF THE INSTITUTE | |
|---|---|
| **M1** | Effectively imparting knowledge and inculcating innovative thinking. |
| **M2** | Facilitating skill enhancement through add on courses and hands on training. |
| **M3** | Doing original, socially relevant, high quality research. |
| **M4** | Instilling the spirit of integrity, equity, professional ethics and social harmony. |

VISION & MISSION - Best Deemed University in Chennai










# DEPARTMENT OF BIOMEDICAL ENGINEERING

| VISION OF THE DEPARTMENT |
|---|
| To be a Centre of excellence in Biomedical Engineering by imparting technical knowledge and nurture talents with strong research focus towards betterment of healthy nation. |

| MISSION OF THE DEPARTMENT | |
|---|---|
| **M1** | To provide quality education in Biomedical Engineering by effective teaching learning process and inculcating value-based education. |
| **M2** | To promote collaborative research with academic institution, hospitals and health care industries to develop leadership and professional skills |
| **M3** | To encourage innovation and research for developing advanced technologies that improve healthcare systems. |
| **M4** | To inculcate societal and ethical values, teamwork, multidisciplinary approaches, and lifelong learning for successful global careers and entrepreneurship. |

| PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) | |
|---|---|
| **PEO1** | Graduates will be successfully employed as Biomedical Engineers and related professionals in industries, hospitals, academic institutions, research organisations and government sectors. |
| **PEO2** | Graduates will pursue higher education, research, entrepreneurship and continuous professional development in Biomedical Engineering amd related fields |
| **PEO3** | Graduates will apply engineering knowledge and innovative technologies to develop effective solutions for improving healthcare systems and society. |
| **PEO4** | Graduates will demonstrate leadership, teamwork, ethical values, and decision-making skills to work effectively in multidisciplinary and global environments |

| PROGRAMME OUTCOMES (POs) | |
|---|---|
| **PO1** | **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified to develop to the solution of complex engineering problems. |
| **PO2** | **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. |
| **PO3** | **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. |
| **PO4** | **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. |
| **PO5** | **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. |
| **PO6** | **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. |
| **PO7** | **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. |
| **PO8** | **Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams. |
| **PO9** | **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences |
| **PO10** | **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments. |
| **PO11** | **Life-LongLearning:** Recognize the need for, and have the preparation and ability for<br>i) Independent and life-long learning.<br>ii)adaptability to new and emerging technologies.<br>iii) critical thinking in the broadest context of technological change |

## KNOWLEDGE AND ATTRIBUTE PROFILE (WK)

The Knowledge and Attitude Profile (WK) is intended to define the essential knowledge base and professional attitudes expected of program graduates. It ensures alignment with OBE principles and equips graduates with the capability to effectively analyze and address complex engineering problem.

| | |
|---|---|
| **WK1** | A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences. |
| **WK2** | Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline. |
| **WK3** | A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline. |
| **WK4** | Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline |
| **WK5** | Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area. |
| **WK6** | Knowledge of engineering practice (technology) in the practice areas in the engineering discipline. |
| **WK7** | Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development. |
| **WK8** | Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues. |
| **WK9** | Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes. |

| PROGRAMME SPECIFIC OUTCOMES (PSOs) | |
|---|---|
| **PSO1** | Apply biomedical engineering principles to design and develop innovative medical devices and assistive systems for diagnosis, therapy, and patient care. |
| **PSO2** | Utilize advanced tools and technologies to develop smart healthcare solutions for biomedical signal processing, medical imaging, rehabilitation, and clinical decision support |

| METRICS AND PERFORMANCE INDICATORS | | | |
|---|---|---|---|
| **COMPETENCIES** | | **PERFORMANCE INDICATORS** | |
| **PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.** | | | |
| 1.1 | Demonstrate competence in mathematical modeling | 1.1.1 | Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems |
| | | 1.1.2 | Apply advanced mathematical techniques to model and solve engineering problems |
| 1.2 | Demonstrate competence in basic sciences | 1.2.1 | Apply laws of natural science to an engineering problem |
| 1.3 | Demonstrate competence in engineering fundamentals | 1.3.1 | Apply fundamental engineering concepts to solve engineering problems |
| 1.4 | Demonstrate competence in specialized engineering knowledge to the program | 1.4.1 | Apply basic biomedical engineering concepts to solve engineering problems. |
| **PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.** | | | |
| 2.1 | Demonstrate an ability to identify and formulate complex engineering problem | 2.1.1 | Articulate problem statements and identify objectives |
| | | 2.1.2 | Identify engineering systems, variables, and parameters to solve the problems and mathematical, engineering and other relevant knowledge that applies to a given problem |
| 2.2 | Demonstrate an ability to formulate a solution plan and methodology for an engineering Problem | 2.2.1 | Reframe complex problems into interconnected sub-problems and Identify, assemble and evaluate information and resources. |
| | | 2.2.2 | Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions |
| 2.3 | Demonstrate an ability to formulate and interpret a model | 2.3.1 | Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy. |
| | | 2.3.2 | Identify assumptions (mathematical and physical) necessary to allow modelling of a system at the level of accuracy required. |
| 2.4 | Demonstrate an ability to execute a solution | 2.4.1 | Apply engineering mathematics and computations to solve mathematical models |
| | | 2.4.2 | Produce and validate results through skilful use of contemporary engineering tools and models |

| | | | |
|---|---|---|---|
| | process and analyze results | 2.4.3 | Identify sources of error in the solution process, and limitations of the solution. |
| | | 2.4.4 | Extract desired understanding and conclusions consistent with objectives and limitations of the analysis |
| **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 public health and safety, and cultural, societal, and environmental considerations.** | | | |
| 3.1 | Demonstrate an ability to define a complex/ open- ended problem in engineering terms | 3.1.1 | Recognize that need analysis is key to good problem definition |
| | | 3.1.2 | Elicit and document, engineering requirements from stakeholders and Synthesize engineering requirements from a review of the state-of-the-art |
| | | 3.1.3 | Extract engineering requirements from relevant engineering Codes and Standards |
| | | 3.1.4 | Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues and Determine design objectives, functional requirements and arrive at specifications |
| 3.2 | Demonstrate an ability to generate a diverse set of alternative design solutions | 3.2.1 | Apply formal idea generation tools to develop multiple engineering design solutions |
| | | 3.2.2 | Build models/prototypes to develop a diverse set of design solutions and Identify suitable criteria for the evaluation of alternate design solutions |
| 3.3 | Demonstrate an ability to select an optimal design scheme for further development | 3.3.1 | Apply formal decision-making tools to select optimal engineering design solutions for further development |
| | | 3.3.2 | Consult with domain experts and stakeholders to select candidate engineering/ biomedical engineering design solution for further development |
| 3.4 | Demonstrate an ability to advance an engineering design to defined end state | 3.4.1 | Refine a conceptual design into a detailed design within the existing constraints (of the resources) |
| | | 3.4.2 | Generate information through appropriate tests to improve or revise the design |
| **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.** | | | |
| 4.1 | Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and | 4.1.1 | Define a problem, its scope and importance for purposes of investigation |
| | | 4.1.2 | Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation |
| | | 4.1.3 | Apply appropriate instrumentation and/or software tools to make measurements of physical quantities |

| | | | |
|---|---|---|---|
| | understanding | 4.1.4 | Establish a relationship between measured data and underlying physical principles |
| 4.2 | Demonstrate an ability to design experiments to solve open-ended problems | 4.2.1 | Design and develop an experimental approach, specify appropriate equipment and procedures |
| | | 4.2.2 | Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives |
| 4.3 | Demonstrate an ability to analyze data and reach a valid conclusion | 4.3.1 | Use appropriate procedures, tools and techniques to conduct experiments and collect data |
| | | 4.3.2 | Analyze data for trends and correlations, stating possible errors and limitations |
| | | 4.3.3 | Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions |
| | | 4.3.4 | Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions |
| **PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.** | | | |
| 5.1 | Demonstrate an ability to identify/ create modern engineering tools, techniques and resources | 5.1.1 | Identify modern engineering tools such as computer-aided drafting, modeling and analysis; techniques and resources for engineering activities |
| | | 5.1.2 | Create/adapt/modify/extend tools and techniques to solve engineering problems |
| 5.2 | Demonstrate an ability to select and apply discipline-specific tools, techniques and resources | 5.2.1 | Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs. |
| | | 5.2.2 | Demonstrate proficiency in using discipline-specific tools |
| 5.3 | Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering Problem | 5.3.1 | Discuss limitations and validate tools, techniques and resources |
| | | 5.3.2 | Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use. |
| **PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.** | | | |
| 6.1 | Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public | 6.1.1 | Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level |

| | | | |
|---|---|---|---|
| | welfare | | |
| 6.2 | Demonstrate an understanding of professional engineering regulations, legislation and standards | 6.2.1 | Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public |
| 6.3 | Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts | 6.3.1 | Identify risks/impacts in the life-cycle of an engineering product or activity |
| | | 6.3.2 | Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability |
| 6.4 | Demonstrate an ability to apply principles of sustainable design and development | 6.4.1 | Describe management techniques for sustainable development |
| | | 6.4.2 | Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline |
| **PO 7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.** | | | |
| 7.1 | Demonstrate an ability to recognize ethical dilemmas | 7.1.1 | Identify situations of unethical professional conduct and propose ethical alternatives |
| 7.2 | Demonstrate an ability to apply the Code of Ethics | 7.2.1 | Identify tenets of the professional code of ethics as Biomedical Engineers |
| | | 7.2.2 | Examine and apply moral & ethical principles to known case studies |
| **PO 8: Individual and Collaborative Teamwork: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.** | | | |
| 8.1 | Demonstrate an ability to form a team and define a role for each member | 8.1.1 | Recognize a variety of working and learning preferences; appreciate the value of diversity on a team |
| | | 8.1.2 | Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal. |
| 8.2 | Demonstrate effective individual and team operations--communication, problem-solving, conflict resolution and leadership skills | 8.2.1 | Demonstrate effective communication, problem-solving, conflict resolution and leadership skills |
| | | 8.2.2 | Treat other team members respectfully, Listen to other members and Maintain composure in difficult situations |

| | | | |
|---|---|---|---|
| 8.3 | Demonstrate success in a team- based project | 8.3.1 | Present results as a team, with smooth integration of contributions from all individual efforts |
| **PO 9: Communication: Communicate effectively on complex engineering activities with the engineering community and with the 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** | | | |
| 9.1 | Demonstrate an ability to comprehend technical literature and document project work | 9.1.1 | Read, understand and interpret technical and non-technical information |
| | | 9.1.2 | Produce clear, well-constructed, and well-supported written engineering documents and Create flow in a document or presentation - a logical progression of ideas so that the main point is clear |
| 9.2 | Demonstrate competence in listening, speaking, and presentation | 9.2.1 | Listen to and comprehend information, instructions, and viewpoints of others |
| | | 9.2.2 | Deliver effective oral presentations to technical and non-technical audiences |
| 9.3 | Demonstrate the ability to integrate different modes of communication | 9.3.1 | Create engineering-standard figures, reports and drawings to complement writing and presentations |
| | | 9.3.2 | Use a variety of media effectively to convey a message in a document or a presentation |
| **PO 10: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.** | | | |
| 10.1 | Demonstrate an ability to evaluate the economic and financial performance of an engineering activity | 10.1.1 | Describe various economic and financial costs/benefits of an engineering activity |
| 10.2 | Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity | 10.2.1 | Analyze different forms of financial statements to evaluate the financial status of an engineering project |
| | | 10.2.2 | Analyze and select the most appropriate proposal based on economic and financial considerations. |
| 10.3 | Demonstrate an ability to plan/manage an engineering activity within time and budget constraints | 10.3.1 | Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks. |
| | | 10.3.2 | Use project management tools to schedule an engineering project, so it is completed on time and on budget. |
| **PO 11: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.** | | | |

| | | | |
|---|---|---|---|
| 11.1 | Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps | 11.1.1 | Describe the rationale for the requirement for continuing professional development |
| | | 11.1.2 | Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap |
| 11.2 | Demonstrate an ability to identify changing trends in engineering knowledge and practice | 11.2.1 | Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current |
| | | 11.2.2 | Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field |
| 11.3 | Demonstrate an ability to identify and access sources for new information | 11.3.1 | Source and comprehend technical literature and other credible sources of information |
| | | 11.3.2 | Analyze sourced technical and popular information for feasibility, viability, sustainability, etc. |
| **PSO1: Apply biomedical engineering principles to design and develop innovative medical devices and assistive systems for diagnosis, therapy, and patient care.** | | | |
| 1.1 | Ability to design and develop biomedical devices for healthcare applications | 1.1.1 | Identify clinical needs and translate them into biomedical device designs. |
| | | 1.1.2 | Develop and test biomedical device prototypes considering safety and functionality. |
| 1.2 | Ability to develop patient-centered assistive innovative technologies | 1.2.1 | Design assistive systems to improve patient care in Medical field |
| | | 1.2.2 | Evaluate device performance, usability, and reliability in healthcare environments. |
| **PSO2: Utilize advanced tools and technologies to develop smart healthcare solutions for biomedical signal processing, medical imaging, rehabilitation, and clinical decision support** | | | |
| 2.1 | Ability to apply advanced computational tools for biomedical applications | 2.1.1 | Develop algorithms for biomedical signal and medical image processing. |
| | | 2.1.2 | Use software and simulation tools for healthcare data analysis and system development. |
| 2.2 | Ability to implement intelligent and smart healthcare technologies | 2.2.1 | Apply AI, IoT, and embedded technologies in healthcare systems. |
| | | 2.2.2 | Develop clinical decision-support and patient monitoring solutions using modern technologies. |

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES**

**(VISTAS)**

**(Deemed to be University Estd. u/s 3 of the UGC ACT, 1956)**

**SCHOOL OF ENGINEERING UG REGULATIONS - 2026**

Effective from the academic year 2026-2027 and applicable to the students to be admitted in **School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS),** Chennai.

## 1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- "**Programme**" refers to the Degree Programme that is B.Tech.
- "**Discipline**" refers to specialization or branch of B.Tech. Degree Programme, like Electronics and Communication Engineering, Computer Science and Engineering etc.
- "**Course**" refers to theory or laboratory subject like Engineering Physics, Computer Programming etc.
- **"Registrar"** refers to the authority of the Institution who is responsible for all academic activities of the Departments for implementation of relevant rules and regulations.
- **"Controller of Examinations"** refers to the authority of the Institution who is responsible for all activities related to examinations.
- **"Institution"** refers to VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS**),** CHENNAI.

## 2. ADMISSION

### 2.1 *First semester of the B.Tech. Degree Programme:*

Passed 10+2 examination with Physics/ Mathematics/ Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship as per table 8.4 Agriculture stream (for Agriculture Engineering) Obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together.

OR

Passed D.Voc. Stream in the same or allied sector.

Admission to the B.Tech. programmes shall be offered to candidates who satisfy the eligibility criteria prescribed by AICTE and have qualified in the VISTAS Scholastic Aptitude Test (VSAT) conducted by the University.

The selection of candidates shall be based on their performance in VSAT and/or academic performance in the qualifying examination, as prescribed by the University from time to time.

Candidates shall have passed the Higher Secondary Examination (10+2 pattern) or its equivalent with Physics, Chemistry, and Mathematics as compulsory subjects and shall satisfy the minimum eligibility requirements stipulated by VISTAS and the statutory authorities.

### 2.2 Lateral entry to second year

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.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR

Passed B.Voc/3-year D.Voc. Stream in the same or allied sector.

### 2.3 Lateral entry to third year

Candidates with a UG Diploma in Engineering are eligible for lateral entry admission directly into the third year of the relevant undergraduate engineering programme.

### 2.4 Lateral entry to final year

Candidates with a B.Voc. degree in the relevant discipline are eligible for lateral entry admission directly into the final year of the corresponding undergraduate programme.

## 3. PROGRAMMES OFFERED

A candidate may be offered a programme in any one of the branches of study approved by the Institution.

## 4. STRUCTURE OF THE PROGRAMMES

### 4.1 *Curriculum and Syllabi*

Every Programme will have curriculum with syllabi consisting of theory and practicals such as:

| COURSE CATEGORY | DESCRIPTION AND SPECIFIC DETAILS |
|---|---|
| **Basic Science Course (BSC)** | Mathematics, Physics, Chemistry, Biology, etc. |
| **Program Core Courses (PCC)** | Allows students to pursue a secondary interest (e.g., Cyber Security, Management, or even Performing Arts). |
| **Professional Elective Course (PEC)** | core courses relevant to the chosen specialization/branch. |
| **Multi-disciplinary Core Courses (MDC)** | Courses on sciences, humanities, or social sciences. |

| | |
|---|---|
| **Multi-disciplinary Elective Courses** (MDE) | Courses from other branches which a student can choose from the list specified in the curriculum of the students B. Tech. Programmes. |
| **Skill Enhancement Courses (SEC)** | Courses on hands-on technical skills, **employability skills**, soft skills, and life skills. |
| **Ability Enhancement Courses (AEC)** | Courses on language proficiency and communication skills. |
| **Value-Added Courses (VAC)** | Courses on **Indian Knowledge Systems (IKS)**, Environmental education and constitutional values |
| **Summer Internship (SI)** | Mandatory practical exposure in industry |
| **Project Report and Dissertation (PRD)** | Course on Mini project, Phase I and II |

### 4.2 *Course Components*

Each course includes one or more of the following components,

- **Lecture:** Structured classroom teaching focused on theoretical concepts and subject knowledge delivery.
- **Tutorial:** Interactive learning session intended for discussion, problem-solving, clarification, and guided practice.
- **Practical:** Hands-on learning activity designed to apply theoretical knowledge through experiments, demonstrations, or fieldwork.
- **Self-Learning:** Independent learning undertaken by students through reading, online resources, assignments, projects, and self-paced study activities.

### 4.3 *Personality and Character Development*

All students will undergo structured professional development courses designed to enhance communication, aptitude, soft skills, leadership, and professional competencies of students from the 3rd to 6th semester, with one course offered in each semester. The courses shall focus on improving confidence, interpersonal skills, teamwork, problem-solving ability, and career readiness.

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC/NSS/NSO/YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Service Scheme (NSS) will have social service activities in and around the Institution.

National Sports Organization (NSO) will have sports, Games, Drills and Physical exercises.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

### 4.4 *Credit Distribution*

Each course is assigned certain number of credits based on the following:

| **Learning Component** | Credit Calculation Basis |
|---|---|
| **Lecture (L)** | 1 hour of teaching per week = 1 Credit |
| **Tutorial (T)** | 1 hour of Interactive learning session per week = **1 Credit** |
| **Practical/Lab (P)** | 2 hours of lab work per week = **1 Credit** |

### 4.5 *Pre-requisite for courses*

- A prerequisite course is a course that must be successfully completed before a student is permitted to enroll in a designated higher-level course.
- The Course Coordinator and the Department shall verify and approve the fulfillment of prerequisite requirements after the declaration of the End Semester Examination results of the preceding semester.
- A student may be considered eligible for enrollment in the desired course if any one of the following conditions is satisfied:
    - The student has maintained a minimum attendance of 75% in the prerequisite course.
    - The student has secured at least 50% marks in the Continuous Internal Assessment (CIA) examinations of the prerequisite course.
    - The student has successfully completed an online certification in the same or a related subject through NPTEL or any recognized MOOC platform.
- Students who do not satisfy any of the above criteria, or who were unable to meet the requirements due to valid medical reasons supported by appropriate documentation, shall be required to undergo and successfully complete a 30-hour bridge/crash course conducted by the Department before being permitted to register for the desired course.

### 4.6 *Industrial Training / Internship*

The students may undergo Industrial training for a period as specified in the Curriculum during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Department) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

### 4.7 *Industrial Visit*

Every student is required to go for at least one Industrial Visit every year starting from the second year of the programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

### 4.8 *Medium of Instruction*

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports.

### 4.9 *Massive Open Online Courses (MOOCs)*

- Students opting for an online course shall be required to register for the MOOCs through SWAYAM-NPTEL with the guidance of SPOC/Mentors.
- Credit transfer policy will be applicable to –
  - All UG and PG programmes offered by the Institution.
  - All PCC/PEC/BSC/MDC/MDE/VAC courses offered by the corresponding program.
- Students should have successfully completed the course and received the Marksheet from SWAYAM to opt for credit transfer. They shall apply to the office of the COE through the HOD and SPOC.
- VISTAS shall award the credit of the equivalent core and elective course in the curriculum as credit for the courses completed via SWAYAM/ NPTEL platforms.
- VISTAS shall give the equivalent grade to the students for the credits earned through online learning courses through SWAYAM platform

| SWAYAM Range of Marks | SWAYAM/ NPTEL Type of Certificate | Proposed Equivalent Grade Points (VISTAS) | Proposed Letter Grade (VISTAS) | Proposed Description (VISTAS) |
|---|---|---|---|---|
| **90-100** | Elite + Gold | 10 | O | Outstanding |
| **75-89** | Elite + Silver | 9 | A+ | Excellent |
| **60-74** | Elite | 8 | A | Very Good |
| **40-59** | Successfully Completed | 7 | B+ | Good |

- Credits earned through MOOCs will be incorporated in the mark sheet /final mark sheet issued to the student by the Controller of Examination
- Students who have qualified in the examination conducted by the SWAYAM and opting for Credit Transfer shall be exempted from appearing in Continuous and Semester End examinations for the equivalent course.
- VISTAS also permit students to undergo the same courses and appear for Continuous and Semester End Examinations at VISTAS if they desire to do so for a better performance.

### 4.10 *Honors and Minor Degree*

- **Honours Degree**

  An Honours Programme enables a student to acquire advanced knowledge and specialization in an emerging, multidisciplinary, or industry-relevant area within the same discipline/department. To earn an Honours credential, the student shall study and successfully

complete additional courses carrying 18–20 extra credits beyond the credit requirements of the regular degree programme, as specified in the curriculum.

- **Minor Degree**

  A Minor Degree enables a student to gain interdisciplinary knowledge and specialization in a discipline other than the parent department. To earn a Minor Degree, the student shall study and successfully complete additional courses carrying 18–20 extra credits beyond the credit requirements of the regular degree programme, as specified in the curriculum of the respective department.

- Students who satisfy the eligibility criteria prescribed by the University may opt to pursue either an Honours Programme or a Minor Degree in addition to their regular degree programme. The award of an Honours Programme or Minor Degree shall be subject to the successful completion of the prescribed additional courses and the attainment of the required 18–20 extra credits**.** The detailed regulations, eligibility requirements, credit requirements, and award criteria shall be governed by the guidelines issued by the University from time to time.
- The Department shall offer Honours or Minor programmes irrespective of the number of students enrolled.
- If a student discontinues Honours:
  - The completed additional courses may be considered in place of Professional Electives.
  - Courses with higher grades will be considered for CGPA calculation.
  - The other completed courses will appear in the grade sheet but will not be accounted for CGPA calculation.
  - Failed courses or courses with shortage of attendance will not appear in the grade sheet or CGPA calculation.
- If a student discontinues Minor:
  - The completed additional courses may be considered in place of Open Electives.
  - Courses with higher grades will be considered for CGPA calculation.
  - The other completed courses will appear in the grade sheet but will not be accounted for CGPA calculation.
  - Failed courses or courses with shortage of attendance will not appear in the grade sheet or CGPA calculation.
- Students must register for honors or minor degrees separately for these additional courses and pay the prescribed tuition and examination fees.

### 4.11 *Semester Abroad and Twinning Programmes*

Students may undergo a Semester Abroad / Twinning Programme at approved foreign universities or Institutions having academic collaboration with the Institution. The maximum duration permitted for a Semester Abroad Programme shall be six months, while the maximum duration permitted for a Twinning Programme shall be one year. A maximum of 30% of the total credits prescribed for the degree programme may be earned through the Semester Abroad / Twinning Programme.

Courses and credits completed at the host institution shall be approved by the Department and may be transferred to the respective programme as per the norms of the Institution. Students shall comply with the academic and disciplinary regulations of both the parent

institution and the host institution during the programme period.

### 4.12 *Dual Degree*

The programme shall be offered only through institutions having a valid academic collaboration or Memorandum of Understanding (MoU) with the parent institution.

Students opting for a Dual Degree Programme shall fulfill the eligibility criteria and academic requirements prescribed by both participating institutions. The duration, course structure, credit transfer, and degree requirements shall be governed by the regulations approved by the respective institutions. Students shall comply with the

academic, disciplinary, and administrative rules of both institutions throughout the period of study.

The award of the dual degree shall be subject to the successful completion of all prescribed credits, project requirements, and assessment criteria of both programmes.

### 4.13 *Joint Degree*

The Institution may offer Joint Degree Programmes in collaboration with recognized national or international institutions having a valid academic collaboration agreement or Memorandum of Understanding (MoU).

The curriculum, duration of study, credit requirements, and evaluation pattern for the Joint Degree Programme shall be jointly approved by the participating institutions in accordance with the applicable regulatory norms. Students admitted to the Joint Degree Programme shall comply with the academic, administrative, and disciplinary regulations of all participating institutions. Credits earned at the partner institution shall be transferred and considered for the award of the Joint Degree as per the approved credit transfer policy of the Institution.

The Joint Degree shall be awarded upon successful completion of all prescribed academic requirements, including coursework, project work, internship, and examinations, as specified in the programme regulations.

### 4.14 *Two Academic Programmes*

A student may be permitted to pursue two academic programmes simultaneously, subject to the regulations and approval of the Institution where one of the two programmes may be pursued in online, open and distance learning, or hybrid mode, as permitted by the applicable regulatory norms.

The student shall satisfy the eligibility, attendance, academic, and examination requirements prescribed for both programmes independently. Credits earned in one programme shall not be transferred to the other programme unless specifically approved by the Institution.

The award of degrees shall be based on the successful completion of all requirements prescribed for the respective programmes.

### 4.15 *Transfer of credits from other Institution*

Students may be permitted to transfer credits earned from recognized Indian or Foreign Higher Educational Institutions, subject to the norms, conditions, and credit limits prescribed by the UGC.

- Twinning Programme: Credits earned from the Foreign Higher Educational Institution shall not exceed 30% of the total credits of the programme.
- Joint Degree Programme: Students must earn at least 30% of the total credits from each of the Indian and Foreign Higher Educational Institutions.
- Dual Degree Programme: Students must earn at least 30% of the total credits from the Indian Institution.

### 4.16 *Advanced and Differential Learners*

Students securing a CGPA above 8.0 shall be identified as Advanced Learners and may be permitted to register for a maximum of three additional courses per semester along with flexible attendance provisions from the second year onwards.

Students requiring additional academic support shall be identified as Differential Learners and may be provided with bridge courses, remedial classes, mentoring, and other academic assistance measures

## 5. DURATION OF THE PROGRAMME

5.1 A student is expected to complete the B.Tech. Programme in 8 semesters (four academic years) but in any case, not more than 14 Semesters.

5.2 To support lifelong learning, the curriculum follows multiple entry multiple exit pathways as described below,

| **Pathway/Stage** | **Qualification Awarded** | **Additional Requirement** | **Re-entry & Validity Terms** |
|---|---|---|---|
| Exit after Year 1 | **Undergraduate (UG) Certificate** | Completion of a minimum of 40 credits followed by an additional **4-credit skill-based exit module** during the summer. | Credits earned are stored in the **Academic Bank of Credits (ABC)** and are typically valid for **7 years**. |
| Exit after Year 2 | **Undergraduate (UG) Diploma** | Completion of a minimum of 80 credits followed by an additional **4-credit skill-based exit module**. | Students can return to the ecosystem to progress to the next level within the valid period. |

| | | | |
|---|---|---|---|
| Exit after Year 3 | **B.Voc. degree** | Completion of a minimum of 120 credits followed by an additional **4-credit skill-based exit module**. | Students can return to the ecosystem to progress to the next level within the valid period. |
| Re-entry | **N/A (Vertical Mobility)** | Redemption of accumulated credits stored against the student's **APAAR ID** in the ABC. | Re-entry after the 7-year validity period requires **re-validation** of prior learning outcomes through fresh assessment. |

5.3 Each semester shall normally consist of 90 working days or 450 periods. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods / hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.3) in order that he/she may be eligible for the award of the degree (vide clause 16).

5.5 In special and exceptional cases, a further extension of **one year** may be permitted with the approval of the **Executive Council (EC)**, subject to the recommendation of the Head of the Institution and compliance with the applicable regulations.

## 6. ATTENDANCE REQUIREMENTS

6.1 Students are expected to attend all classes regularly and maintain a minimum attendance of 75% in each course.

6.2 It is the responsibility of every student to monitor their attendance percentage in each course and ensure compliance with the attendance regulations prescribed by VISTAS. Any discrepancy in attendance records should be immediately brought to the notice of the concerned faculty member for necessary correction.

6.3 Attendance relaxation up to 10% may be considered for valid reasons such as medical emergencies, on-duty assignments, extracurricular or extramural activities, permitted academic assignments, job interviews, inter-university sports meets, competitions, and other unforeseen emergencies.

6.4 Students who do not maintain the minimum attendance requirement of 75% in any course will not be permitted to appear for the End Semester Examination for that course.

6.5 The registration for such course(s) will be treated as cancelled, and the student will be

awarded an 'I' Grade ('I' indicates Incomplete / Registration cancelled due to shortage of attendance). This grade will remain in the grade sheet until the course is successfully completed.

6.6 Students who fail to maintain the minimum attendance requirement of 75% in one or two courses may be permitted to attend additional classes on payment of the prescribed fee, and shall be allowed to appear for the End Semester Examination upon securing full attendance and satisfactory performance in such classes, as recommended by the course instructor and approved by the Institution.

6.7 A candidate who secures overall attendance between 65% and 74% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / Participation in Sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate attested by the Dean of the School.

6.8 The overall attendance below 65% shall not be condoned under any circumstances.

6.9 A student whose overall attendance is below 65%, or whose shortage of attendance has not been condoned, shall be detained from appearing for the End Semester Examination of that semester.

6.10 Such a student shall be required to re-register for and repeat the semester/course(s) in accordance with the regulations of the University and shall fulfill the prescribed attendance requirements afresh.

6.11 Students from the second year onwards securing a CGPA of 8.0 and above may be granted flexible attendance, subject to the approval of the Institution, to pursue approved academic, research, internship, innovation, or entrepreneurial activities.

## 7. CLASS ADVISER AND MENTORS

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the students will attach a certain number of students to a teacher of the Department who shall function as Class Adviser for those students throughout their period of study. Such Class Advisers shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students attached to him/her and counsel them periodically. If necessary, the Class adviser may also discuss with or inform the parents about the progress of the students.

Every student will also be allotted a mentor from the faculty of the department to guide him/her personally. The mentors will work in close association with the Class advisor to understand the progress of the students and provide the needed guidance.

## 8. COURSE COMMITTEE

Each common theory course offered to more than one discipline or class of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator.

The nomination of the course coordinator shall be made by the Head of the Department / Dean depending upon whether all the teachers teaching the common course belong to a single department or to several departments.

The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the assessments and shall ensure a uniform evaluation.

## 9. CLASS COMMITTEE

9.1 A Class Committee (CCM) shall be constituted for every class/semester consisting of the HoD, Chairperson, faculty members, and student representatives.

9.2 Each department shall nominate a faculty member as the Class Committee Coordinator to monitor and organize the meetings.

9.3 The Chairperson shall be nominated by the HoD and CCM Coordinator on a rotational basis.

9.4 Student representatives shall be selected based on academic performance, discipline, attendance, and participation in co-curricular/extracurricular activities, ensuring fair representation of all student categories.

9.5 Class Committee Meetings shall be conducted periodically, preferably before every assessment examination, as per the academic schedule.

9.6 The committee shall review syllabus coverage, teaching–learning processes, assessment methods, student performance, attendance, and discipline.

9.7 Student feedback regarding courses, faculty, infrastructure, placement training, and other academic/non-academic matters shall be discussed for continuous improvement.

9.8 Remedial actions, corrective measures, and follow-up plans for academic and student-related issues shall be identified and implemented.

9.9 Minutes of the meeting, including discussions, decisions, and action taken reports, shall be properly documented and maintained in both soft and hard copies.

9.10 The Class Committee shall function as a quality enhancement mechanism to improve academic performance, student support, and the overall teaching–learning environment.

## 10. SYSTEM OF EXAMINATION

10.1 Performance in each course of study shall be evaluated based on (i) continuous assessment throughout the semester and (ii) End Semester Examinations at the end of the semester.

10.2 Each course, both theory and practical (including project work & Viva voce Examinations) shall be evaluated for a maximum of 100 marks.

10.3 For all theory and practical courses including project work, the continuous assessment will carry 40 marks while the End Semester examination will carry 60 marks.

10.4 Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

10.5 For theory cum practical courses, the practical component will be evaluated during the continuous assessments. End Semester examination will be similar to theory courses for 60 marks.

10.6 The end semester examination (theory and practical) of 3 hours duration shall ordinarily be conducted between November and December during the odd semesters and between April and May during the even semesters.

10.7 The end semester examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the

guide of the project group and an internal examiner.

10.8 For the end semester examination in both theory and practical courses including project work the internal and external examiners shall be appointed by Controller of Examinations.

## 11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

### 11.1 *Theory Courses*

The distribution of internal assessment marks for theory courses shall be as follows:

| S.No | Description | | Marks |
|---|---|---|---|
| **1** | Two Continuous Assessment (C.A) Class Tests | (2 x 10) | **20** |
| **2** | Model Examination | (1 x 15) | **15** |
| **3** | Assignments / Class Seminar | (1 x5) | **05** |
| **Total** | | | **40** |

### 11.2 *Practical Courses*

Every practical exercise / experiment shall be evaluated based on the exercise / experiment prescribed as per the syllabi and the records of work done maintained. There shall be at least one test during the semester. The criteria for arriving at the continuous assessment marks (40 marks) shall be decided based on the recommendation of the course committee/department advisory committee and shall be announced at the beginning of every semester by the Head of the Department.

### 11.3 *Project Work:*

11.3.1 The allotment of guides for eligible UG students must be done before the semester starts. All students are required to do Projects in Reputed Industry / Laboratory to promote academic industrial interaction and to provide professional expertise in selected fields of interest. Under this program, projects are formulated and implemented jointly by specialists from the industries and faculty members of the institute.

11.3.2 The Dean shall constitute a review committee for each branch of study. There shall be three reviews (each 100 Marks) during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be reduced for 3 0 marks and rounded to the nearest integer. (This also implies equal weightage to all the three assessments), 5 marks shall be given for Attendance (Clause 11.3), and 5 marks shall be given for Student's Assesment by Faculty.

11.3.3 The project report shall carry a maximum 20 marks (same mark shall be awarded for the report submitted to every student within the project group) while the viva-voce examination shall carry 40 marks. (Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination).

11.3.4 If a candidate fails to submit the project report on or before the specified deadline, he / she is deemed to have failed in the Project Work and shall re-register for the same in a subsequent semester.

11.3.5 Students who are entrepreneurs with registered startups may be permitted to undertake

startup-based innovation activities in lieu of the final year project, subject to approval by the Institution.

### 11.4 *Other Employability Enhancement Courses*

11.4.1 The seminar is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

11.4.2 The Industrial / Practical Training, Summer Project, Internship, shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva- Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution.

## 12. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATIONS

A candidate shall be permitted to appear for the End Semester Examinations of any semester commencing from I semester if he/she has satisfied the semester completion requirements (subject to Clause 6) and has registered for examination in all courses of the semester. Registration is mandatory for semester examinations as well as arrear examinations, failing which the candidate will not be permitted to move to the higher semester.

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades / marks.

## 13. PASSING REQUIREMENTS

13.1 A candidate who secures not less than 40% of total marks prescribed for the end- semester Examination in both theory and practical courses (including Project work), shall be declared to have passed the Examination.

13.2 If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations in the failed subjects till he / she secures a pass.

13.3 The continuous assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass.

## 14. AWARD OF LETTER GRADES

### 14.1 *Grade Conversion Table*

The performance of students in each course shall be indicated by Letter Grades and Grade Points based on the range of marks secured, as prescribed in the Grade Conversion Table approved by the Institution.

| Range of | Grade Points | Letter Grade | Description |
|---|---|---|---|
| 90 – 100 | 10 | O | Outstanding |
| 82 – 89 | 9 | A+ | Excellent |
| 75 – 81 | 8 | A | Very Good |
| 67 – 74 | 7 | B+ | Good |
| 60 – 66 | 6 | B | Above Average |
| 50 – 59 | 5 | C | Average |
| 40 – 49 | 4 | D | Minimum for Pass |
| 00 – 39 | 0 | RA | Reappear |
| | | AA | Absent |

### 14.2 *Calculation of GPA and CGPA*

The Grade Point Average (GPA) for the semester GRADE POINT AVERAGE [GPA] is calculated as follows,

$$GPA = \frac{\sum(C \times GP)}{\sum(C)}$$

The Cumulative Grade Point Average (CGPA) is calculated as follows,

$$CGPA = \frac{\sum_{i=1}^{n} (C_i \times GP_i)}{\sum_{i=1} C}$$

where,

n - Number of subjects.

C - Credit for the academic courses successfully completed.

GP - Grade point for the academic courses successfully completed.

## 15. REVALUATION / PHOTOCOPY / REVIEW

15.1 A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Dean of the School. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time. The Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Dean of the School. Revaluation is not permitted for practical courses, seminars, practical training and for

project work.

15.2 A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Department. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

15.3 A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

15.4 Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Department. Candidates applying for Revaluation only are eligible to apply for Review.

## 16. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the award of the Degree if he/she has,

- Successfully gained the required number of total credits as specified in the Curriculum corresponding to his/her Programme within the stipulated time.
- No disciplinary action is pending against him/her.
- Successfully completed the field visit / industrial training, if any, as prescribed in the curriculum.
- The award of the degree must be approved by the Executive Council.

## 17. CLASSIFICATION OF THE DEGREE AWARDED`

17.1 A candidate who qualifies for the award of the degree having passed the examination in all the courses in his / her first appearance within the specified minimum number of semesters securing a CGPA of not less than 7.5 shall be declared to have passed the examination in First class with Distinction. For the purpose the withdrawal from examination will not be construed as an appearance. Further, the authorized break of study will not be counted for the purpose of classification.

17.2 A candidate who qualifies for the award of the degree having passed the examination in all the courses in his / her first appearance within the specified minimum number of semesters plus one year (two semesters), securing a CGPA of not less than 6.50 shall be declared to have passed the examination in First class. Further, the authorized break of study will not be counted for the purpose of classification.

17.3 All other candidates who qualify for the award of the degree shall be declared to have passed the examination in Second Class.

17.4 Students who have been admitted from other Universities under Inter University Transfer are not eligible for Classification.

## 18. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

18.1 A candidate who qualifies for the award of the degree having passed the examination in all the courses in his / her first appearance within the specified minimum number of semesters securing a CGPA of not less than 7.5 shall be declared to have passed the examination in First class with Distinction. For the purpose the withdrawal from examination will not be construed as an appearance. Further, the authorized break of study will not be counted for the purpose of classification.

18.2 A candidate who qualifies for the award of the degree having passed the examination in all the courses in his / her first appearance within the specified minimum number of semesters plus one year (two semesters), securing a CGPA of not less than 6.50 shall be declared to have passed the examination in First class. Further, the authorized break of study will not be counted for the purpose of classification.

18.3 All other candidates who qualify for the award of the degree shall be declared to have passed the examination in Second Class.

18.4 Students who have been admitted from other Universities under Inter University Transfer are not eligible for Classification.

## 19. PROVISION FOR AUTHORISED BREAK OF STUDY

19.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Registrar in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Dean of the School stating the reasons therefor and the probable date of rejoining the programme.

19.2 The candidate permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. If the Regulations is changed, then, those candidates may have to do additional courses as prescribed by the Dean, School of Engineering.

19.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (Vide Clause 14). However, additional break of study granted will be counted for the purpose of classification.

19.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.3) in order that he/she may be eligible for the award of the degree.

19.5 If any student is detained for want of required attendance, the period spent in that semester shall not be considered as permitted 'Break of Study' (Clause 18.3) is not applicable for this case.

## 20. DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and

outside the Institution and not to indulge in any inappropriate or unethical activity. The Registrar shall constitute a disciplinary committee consisting of Dean, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the Institution about the disciplinary action recommended for approval. In case of any serious in disciplinary action which leads to suspension or Dismissal, then a committee shall be constituted by the Institution. In this regard, the member will be nominated by Institution on getting information from the Head of School.

If a student indulges in malpractice in any of the end semester / internal examination he / she shall be liable for punitive action as prescribed by the Institution from time to time.

## 21. REVISION OF REGULATIONS AND CURRICULUM

The Institution may from time-to-time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Board of Studies.

# ABBREVIATIONS

| | |
|---|---|
| SEC | Skill Enhancement Course |
| AEC | Ability Enhancement Course |
| BSC | Basic Science Courses |
| MDC | Multidisciplinary Core |
| PCC | Program Core Courses |
| PEC | Professional Elective Courses |
| MDE | Multidisciplinary Elective |
| VAC | Value Added Course |
| PRD | Project report and Dissertation |
| SI | Summer Internship |

# CURRICULUM STRUCTURE

## B.Tech Biomedical Engineering

**Total number of Credits: 165**

| B.Tech. Biomedical Engineering<br>Minimum Credits to be earned :165 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SEMESTER 1 | | | | | | | | | | |
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| BSC | 26GCMA11 | Mathematics I (Calculus and Linear Algebra) | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| BSC | 26CBPH11 | Physics (Oscillations, waves and optics) | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM11 | Anatomy and Human Physiology | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| MDC | 26CBCE11 | Computer Programming using C | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| VAC | 26EVAC11 | Universal Human Values (Understanding Harmony) | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDC | 26PBCE11 | Computer Programming using C Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| BSC | 26PBPH11 | Physics - Oscillations, Waves and optics Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| SEC | 26MCID11 | IDEA Lab | 0 | 0 | 2 | 2 | 0 | 40 | 60 | 100 |
| VAC | | Student Induction Program | 0 | 0 | 0 | 0 | 0 | - | - | - |
| | | | **14** | **0** | **9** | **23** | **20** | **-** | **-** | **-** |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self –Learning**

| SEMESTER 2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| BSC | 26GCCH21 | Engineering Chemistry | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| BSC | 26CBMA21 | Mathematics II (Transforms & Boundary Value) | 3 | 1 | 0 | 4 | 4 | 40 | 60 | 100 |
| MDC | 26CBEE21 | Fundamentals of Electrical and Electronics sciences | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDC | 26CBBM21 | Computer Programming using Python | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| AEC | 26CENG21 | Technical English | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| AEC | 26PENG21 | Technical English Lab | 0 | 0 | 2 | 2 | 1 | 40 | 60 | 100 |
| VAC | 26EVAC21 | Constitution of India | 1 | 0 | 0 | 1 | 0 | 40 | 60 | 100 |
| BSC | 26GPCH21 | Engineering Chemistry Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| MDC | 26PBEE21 | Fundamentals of Electrical and Electronics sciences Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| | | | 15 | 1 | 10 | 25 | 20 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

| SEMESTER 3 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| BSC | 26CBMA31 | Mathematics III (Probability and Random Process) | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| PCC | 26CBBM31 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| BSC | 26CBBM32 | Biology for Engineers | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| SEC | 26CSEC31 | Aptitude and coding skills -I | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| PCC | 26CBBM33 | Biosensors and Transducers | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| SEC | 26CBSE31 | Design thinking | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| PCC | 26PBBM31 | Biosensors and Transducers Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| PCC | 26PBBM32 | Programming in MATLAB Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| PCC | 26PBBM33 | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| VAC | 26EVAC31 | Gender, Institution and Society | 1 | 0 | 0 | 1 | 0 | 40 | 60 | 100 |
| | | | 17 | 0 | 9 | 27 | 21.5 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

| SEMESTER 4 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| BSC | 26CBMA41 | Mathematics IV - Numerical Methods | 3 | 1 | 0 | 4 | 4 | 40 | 60 | 100 |
| PCC | 26CBBM41 | Analog and Digital Integrated Circuits | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM42 | Bio signal Processing | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM43 | Biochemistry | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| MDC | 26CBMC41 | Fundamentals of Artificial Intelligence | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| SEC | 26CSEC41 | Aptitude and coding skills -II | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| VAC | 26EVAC41 | Basic Life Skills | 2 | 0 | 0 | 2 | 0 | 40 | 60 | 100 |
| PCC | 26PBBM41 | Analog and Digital Integrated Circuits Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| PCC | 26PBBM42 | Bio signal Processing Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| SEC | 26PSEC41 | Co-curricular / Extracurricular Activities -I | 1 | 0 | 0 | 1 | 1 | 40 | 60 | 100 |
| | | | 20 | 1 | 8 | 28 | 23 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

| SEMESTER 5 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| PCC | 26CBBM51 | Diagnostic Instrumentation | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM52 | Biomaterials and Biomechanics | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM53 | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PEC | 26EBBM5X | Professional Elective -I | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDE | 26EBME5X | Open Elective -I | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| SEC | 26CSEC51 | Advanced Aptitude and coding skills -I | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| BSC | 26CBSC51 | Environmental Science Engineering and SDGs | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| PCC | 26PBBM51 | Microprocessor and microcontroller Lab | 0 | 0 | 4 | 2 | 2 | 40 | 60 | 100 |
| PCC | 26PBBM52 | Diagnostic Instrumentation Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| PRD | 26PPRD51 | Mini Project | 0 | 0 | 2 | 2 | 1 | 40 | 60 | 100 |
| | | | 19 | 0 | 9 | 26 | 23.5 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

| SEMESTER 6 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| PCC | 26CBBM61 | Medical Image Processing | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM62 | Biocontrol System | 3 | 0 | 2 | 4 | 4 | 40 | 60 | 100 |
| PEC | 26EBBM6X | Professional Elective -II | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PEC | 26EBBM6X | Professional Elective -III | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDE | 26EBME6X | Open Elective -II | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| SEC | 26CSEC61 | Advanced Aptitude and coding skills -II | 2 | 0 | 0 | 2 | 2 | 40 | 60 | 100 |
| PCC | 26PBBM61 | Medical Image Processing Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| PCC | 26PBBM62 | Biosimulation Lab | 0 | 0 | 3 | 3 | 1.5 | 40 | 60 | 100 |
| SI | 26CINE61 | Internship (Minimum of 1 month) | 0 | 0 | 2 | 2 | 1 | 40 | 60 | 100 |
| | | | 17 | 0 | 10 | 26 | 22 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**
**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

| SEMESTER 7 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| PCC | 26CBBM71 | Therapeutic Equipments | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PCC | 26CBBM72 | Robotics in Medicine | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PEC | 26EBBM7X | Professional Elective -IV | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PEC | 26EBBM7X | Professional Elective -V | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDE | 26EBME7X | Open Elective -III | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| AEC | 26CBAE71 | Innovations and Entrepreneurship | 1 | 0 | 0 | 1 | 1 | 40 | 60 | 100 |
| PCC | 26PBBM71 | Therapeutic Equipments Lab | 0 | 0 | 4 | 2 | 2 | 40 | 60 | 100 |
| PRD | 26PPRD71 | Project Phase-1 /MNC Company Internship (Minimum 3 Months) | 0 | 0 | 6 | 6 | 3 | 40 | 60 | 100 |
| SEC | 26PSEC71 | Co-curricular / Extracurricular Activities- II | 1 | 0 | 0 | 1 | 1 | 40 | 60 | 100 |
| | | | 17 | 0 | 10 | 25 | 22 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self –Learning**

| SEMESTER 8 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hours/Week | | | | | Maximum Marks | | |
| Category | Code | Course | L | T | P | SL | C | CIA | SEE | Total |
| PEC | 26EBBM8X | Professional Elective -VI | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| MDE | 26EBME8X | Open Elective -IV | 3 | 0 | 0 | 3 | 3 | 40 | 60 | 100 |
| PRD | 26PPRD81 | Project Phase II | 0 | 0 | 14 | 14 | 7 | 40 | 60 | 100 |
| | | | 6 | 0 | 14 | 20 | 13 | - | - | - |

**CIA - Continuous Internal Assessment SEE - Semester End Examination**

**L – Lecture, T- Tutorial, P- Practical, SL - Self -Learning**

## BASIC SCIENCE COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| BSC 1 | 26GCMA11 | Mathematics I (Calculus and Linear Algebra) | 3 | 0 | 2 | 4 | 4 |
| BSC 2 | 26CBPH11 | Physics (Oscillations, Waves and optics) | 3 | 0 | 0 | 3 | 3 |
| BSC 3 (LAB) | 26PBPH11 | Physics - Oscillations, Waves and optics Lab | 0 | 0 | 3 | 3 | 1.5 |
| BSC 4 | 26GCCH21 | Engineering Chemistry | 3 | 0 | 0 | 3 | 3 |
| BSC 5 (LAB) | 26GPCH21 | Engineering Chemistry Lab | 0 | 0 | 3 | 3 | 1.5 |
| BSC 6 | 26CBMA21 | Mathematics II (Transforms & Boundary Value) | 3 | 1 | 0 | 4 | 4 |
| BSC 7 | 26CBMA31 | Mathematics III (Probability and Random Process) | 3 | 0 | 2 | 4 | 4 |
| BSC 8 | 26CBBM32 | Biology for Engineers | 3 | 0 | 0 | 3 | 3 |
| BSC 9 | 26CBMA41 | Mathematics IV - Numerical Metho ds | 3 | 1 | 0 | 4 | 4 |
| BSC 10 | 26CBSC51 | Environmental Science Engineering and SDGs | 2 | 0 | 0 | 2 | 2 |

## MULTIDISCIPLINARY CORE COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| MDC 1 | 26CBCE11 | Computer Programming using C | 3 | 0 | 0 | 3 | 3 |
| MDC 2 (LAB) | 26PBCE11 | Computer Programming using C Lab | 0 | 0 | 3 | 3 | 1.5 |
| MDC 3 | 26CBBM21 | Computer Programming using Python | 3 | 0 | 1 | 4 | 4 |
| MDC 4 | 26CBEE21 | Fundamentals of Electrical and Electronics science | 3 | 0 | 0 | 3 | 3 |
| MDC 5 (LAB) | 26PBEE21 | Fundamentals of Electrical and Electronics science Lab | 0 | 0 | 3 | 3 | 1.5 |
| MDC 6 | 26CBMC41 | Fundamentals of Artificial Intelligence | 3 | 0 | 0 | 3 | 3 |

## ABILITY ENHANCEMENT COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| AEC 1 | 26CENG21 | Technical English | 2 | 0 | 0 | 2 | 2 |
| AEC 2 (LAB) | 26PENG21 | Technical English Lab | 0 | 0 | 2 | 1 | 1 |
| AEC 3 | 26CBAE71 | Innovations and Entrepreneurship | 2 | 0 | 0 | 2 | 2 |

## SKILL ENHANCEMENT COURSE

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| SEC 1 | 26MCID11 | IDEA Lab | 0 | 0 | 2 | 1 | 0 |
| SEC 2 | 26CSEC31 | Aptitude and coding skills -I | 2 | 0 | 0 | 2 | 2 |
| SEC 3 | 26CBSE31 | Design thinking | 2 | 0 | 0 | 2 | 2 |
| SEC 4 | 26CSEC41 | Aptitude and coding skills -II | 2 | 0 | 0 | 2 | 2 |
| SEC 5 | 26PSEC41 | Co-Curricular/Extracurricular activities – I | 1 | 0 | 0 | 1 | 1 |
| SEC 6 | 26CSEC51 | Advanced Aptitude and coding skills -I | 2 | 0 | 0 | 2 | 2 |
| SEC 7 | 26CSEC61 | Advanced Aptitude and coding skills -II | 2 | 0 | 0 | 2 | 2 |
| SEC 8 | 26PSEC71 | Co-Curricular/Extracurricular activities - II | 1 | 0 | 0 | 1 | 1 |

## PROGRAM CORE COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| PCC 1 | 26CBBM11 | Anatomy and Human Physiology | 3 | 0 | 2 | 4 | 4 |
| PCC 2 | 26CBBM31 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 3 |
| PCC 3 (LAB) | 26PBBM33 | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 4 | 26CBBM33 | Biosensors and Transducers | 3 | 0 | 0 | 3 | 3 |
| PCC 5 (LAB) | 26PBBM32 | Programming in MATLAB Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 6 (LAB) | 26PBBM32 | Biosensors and Transducers Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 7 | 26CBBM41 | Analog and Digital Integrated Circuits | 3 | 0 | 0 | 3 | 3 |
| PCC 8 (LAB) | 26PBBM41 | Analog and Digital Integrated Circuits Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 9 | 26CBBM42 | Bio signal Processing | 3 | 0 | 0 | 3 | 3 |
| PCC 10 (LAB) | 26PBBM42 | Bio signal Processing Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 11 | 26CBBM43 | Biochemistry | 3 | 0 | 2 | 4 | 4 |
| PCC 12 | 26CBBM52 | Biomaterials and Biomechanics | 3 | 0 | 0 | 3 | 3 |
| PCC 13 | 26CBBM51 | Diagnostic Instrumentation | 3 | 0 | 0 | 3 | 3 |
| PCC 14 (LAB) | 26PBBM52 | Diagnostic Instrumentation Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 15 | 26CBBM53 | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 | 3 |
| PCC 16 (LAB) | 26PBBM51 | Microprocessor and microcontroller Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 17 (LAB) | 26PBBM62 | Biosimulation Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 18 | 26CBBM62 | Biocontrol System | 3 | 0 | 2 | 4 | 4 |
| PCC 19 | 26CBBM61 | Medical Image Processing | 3 | 0 | 0 | 3 | 3 |
| PCC 20 (LAB) | 26PBBM61 | Medical Image Processing Lab | 0 | 0 | 3 | 3 | 1.5 |
| PCC 21 | 26CBBM72 | Robotics in Medicine | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PCC 22 | 26CBBM71 | Therapeutic Equipments | 3 | 0 | 0 | 3 | 3 |
| PCC 23 (LAB) | 26PBBM71 | Therapeutic Equipments Lab | 0 | 0 | 3 | 3 | 1.5 |

## PROFESSIONAL ELECTIVE COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| PEC 1 | 26EBBMXX | Pathology and Microbiology | 3 | 0 | 0 | 3 | 3 |
| PEC 2 | 26EBBMXX | Biomedical informatics | 3 | 0 | 0 | 3 | 3 |
| PEC 3 | 26EBBMXX | Hospital Management | 3 | 0 | 0 | 3 | 3 |
| PEC 4 | 26EBBMXX | Analog and Digital Communications | 3 | 0 | 0 | 3 | 3 |
| PEC 5 | 26EBBMXX | Virtual Instrumentation in medicine | 3 | 0 | 0 | 3 | 3 |
| PEC 6 | 26EBBMXX | Troubleshooting of medical Equipments | 3 | 0 | 0 | 3 | 3 |
| PEC 7 | 26EBBMXX | Principles of 3D Printing Technology in Healthcare | 3 | 0 | 0 | 3 | 3 |
| PEC 8 | 26EBBMXX | Medical Physics | 3 | 0 | 0 | 3 | 3 |
| PEC 9 | 26EBBMXX | Radiological Equipments | 3 | 0 | 0 | 3 | 3 |
| PEC 10 | 26EBBMXX | Brain Computer Interface | 3 | 0 | 0 | 3 | 3 |
| PEC 11 | 26EBBMXX | Medical Optics | 3 | 0 | 0 | 3 | 3 |
| PEC 12 | 26EBBMXX | MEMS and its Biomedical Applications | 3 | 0 | 0 | 3 | 3 |
| PEC 13 | 26EBBMXX | Bio Micro Fluidic Devices | 3 | 0 | 0 | 3 | 3 |
| PEC 14 | 26EBBMXX | Foundation Skills in Integrated product Development | 3 | 0 | 0 | 3 | 3 |
| PEC 15 | 26EBBMXX | Biomedical Device Design and Development | 3 | 0 | 0 | 3 | 3 |
| PEC 16 | 26EBBMXX | Wearable systems | 3 | 0 | 0 | 3 | 3 |
| PEC 17 | 26EBBMXX | Body Area Networks | 3 | 0 | 0 | 3 | 3 |
| PEC 18 | 26EBBMXX | Smart Healthcare Technologies and Systems | 3 | 0 | 0 | 3 | 3 |
| PEC 19 | 26EBBMXX | Rehabilitation Engineering | 3 | 0 | 0 | 3 | 3 |
| PEC 20 | 26EBBMXX | Assistive Technology | 3 | 0 | 0 | 3 | 3 |
| PEC 21 | 26EBBMXX | Ergonomics | 3 | 0 | 0 | 3 | 3 |
| PEC 22 | 26EBBMXX | Sporty Engineering and Technology | 3 | 0 | 0 | 3 | 3 |
| PEC 23 | 26EBBMXX | Medical Robotics | 3 | 0 | 0 | 3 | 3 |
| PEC 24 | 26EBBMXX | Haptic Devices | 3 | 0 | 0 | 3 | 3 |
| PEC 25 | 26EBBMXX | Physiological Modelling | 3 | 0 | 0 | 3 | 3 |
| PEC 26 | 26EBBMXX | Finite Element Methods for Biomedical Engineering | 3 | 0 | 0 | 3 | 3 |
| PEC 27 | 26EBBMXX | Healthcare Information Systems | 3 | 0 | 0 | 3 | 3 |
| PEC 28 | 26EBBMXX | Telemedicine Technology | 3 | 0 | 0 | 3 | 3 |
| PEC 29 | 26EBBMXX | Machine Learning and applications in Healthcare | 3 | 0 | 0 | 3 | 3 |
| PEC 30 | 26EBBMXX | Artificial Intelligence in Healthcare | 3 | 0 | 0 | 3 | 3 |
| PEC 31 | 26EBBMXX | Soft Computing and its Applications | 3 | 0 | 0 | 3 | 3 |
| PEC 32 | 26EBBMXX | Deep Learning | 3 | 0 | 0 | 3 | 3 |
| PEC 33 | 26EBBMXX | Health care data analytics | 3 | 0 | 0 | 3 | 3 |
| PEC 34 | 26EBBMXX | Virtual Augmented and Mixed Reality in Medicine | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PEC 35 | 26EBBMXX | Pattern Recognition and Neural Networks | 3 | 0 | 0 | 3 | 3 |

## MULTIDISCIPLINARY ELECTIVE COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| MDE 1 | 26EBMEXX | Foreign Language - 1 (Japanese) | 3 | 0 | 0 | 3 | 3 |
| MDE 2 | 26EBMEXX | Foreign Language - 2 (German) | 3 | 0 | 0 | 3 | 3 |
| MDE 3 | 26EBMEXX | Foreign Language - 3 (French) | 3 | 0 | 0 | 3 | 3 |
| MDE 4 | 26EBMEXX | Health policy and Equipment Management | 3 | 0 | 0 | 3 | 3 |
| MDE 5 | 26EBMEXX | Clinical Engineering | 3 | 0 | 0 | 3 | 3 |
| MDE 6 | 26EBMEXX | Lasers in Medicine | 3 | 0 | 0 | 3 | 3 |
| MDE 7 | 26EBMEXX | Fundamentals of Biomedical Engineering | 3 | 0 | 0 | 3 | 3 |
| MDE 8 | 26EBMEXX | Health Information System | 3 | 0 | 0 | 3 | 3 |
| MDE 9 | 26EBMEXX | Internet of Medical Things | 3 | 0 | 0 | 3 | 3 |
| MDE 10 | 26EBMEXX | Introduction to Psychology | 3 | 0 | 0 | 3 | 3 |
| MDE 11 | 26EBMEXX | Biomedical Signal Processing | 3 | 0 | 0 | 3 | 3 |
| MDE 12 | 26EBMEXX | Home Medicare Technology | 3 | 0 | 0 | 3 | 3 |
| MDE 13 | 26EBMEXX | Biomaterials | 3 | 0 | 0 | 3 | 3 |
| MDE 14 | 26EBMEXX | Medical Ethics and Intellectual Property Rights | 3 | 0 | 0 | 3 | 3 |
| MDE 15 | 26EBMEXX | Total Quality Management | 3 | 0 | 0 | 3 | 3 |
| MDE 16 | 26EBMEXX | Regulatory Aspects in Bioscience | 3 | 0 | 0 | 3 | 3 |
| MDE 17 | 26EBMEXX | Advanced Medical Coding | 3 | 0 | 0 | 3 | 3 |
| MDE 18 | 26EBMEXX | Entrepreneurship for Medical Engineers | 3 | 0 | 0 | 3 | 3 |
| MDE 19 | 26EBMEXX | Disaster Management | 3 | 0 | 0 | 3 | 3 |
| MDE 20 | 26EBMEXX | NPTEL Course - Medical Image Analysis | 3 | 0 | 0 | 3 | 3 |
| MDE 21 | 26EBMEXX | NPTEL Course - Computer Aided Drug Design | 3 | 0 | 0 | 3 | 3 |
| MDE 22 | 26EBMEXX | NPTEL Course - Tissue Engineering | 3 | 0 | 0 | 3 | 3 |
| MDE 23 | 26EBMEXX | NPTEL Course - Biomedical Nanotechnology | 3 | 0 | 0 | 3 | 3 |
| MDE 24 | 26EBMEXX | NPTEL Course - Biomedical Imaging Systems | 3 | 0 | 0 | 3 | 3 |
| MDE 25 | 26EBMEXX | NPTEL - Basic Course in Biomedical Research | 3 | 0 | 0 | 3 | 3 |
| MDE 26 | 26EBMEXX | NPTEL Biomedical Instrumentation and Sensors | 3 | 0 | 0 | 3 | 3 |
| MDE 27 | 26EBMEXX | NPTEL - Introduction to Biomedical optics | 3 | 0 | 0 | 3 | 3 |
| MDE 28 | 26EBMEXX | NPTEL Microsensors, Implantable Devices and Rodents Surgeries for Biomedical Applications | 3 | 0 | 0 | 3 | 3 |
| MDE 29 | 26EBMEXX | Indian Knowledge Systems | 3 | 0 | 0 | 3 | 3 |
| MDE 30 | 26EBMEXX | Professional Ethics | 3 | 0 | 0 | 3 | 3 |

## VALUE ADDED COURSES

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| VAC 1 | 26EVAC11 | Universal Human Values (Understanding Harmony) | 3 | 0 | 0 | 3 | 3 |
| VAC 2 | - | Student Induction Program | 0 | 0 | 0 | 0 | 0 |
| VAC 3 | 26EVAC21 | Constitution of India | 1 | 0 | 0 | 1 | 0 |
| VAC 4 | 26EVAC31 | Gender, Institution and Society | 1 | 0 | 0 | 1 | 0 |
| VAC 5 | 26EVAC41 | Basic Life Skills | 2 | 0 | 0 | 2 | 0 |

## SUMMER INTERNSHIP

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| SI 1 | 26CINE61 | Internship (Minimum of 1 month) | 0 | 0 | 2 | 2 | 1 |

## PROJECT REPORT AND DISSERTATION

| Category | Code | Course | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| PRD 1 | 26PPRD51 | Mini Project | 0 | 0 | 2 | 2 | 1 |
| PRD 2 | 26PPRD71 | Project Phase-1 /MNC Company Internship (Minimum 3 Months) | 0 | 0 | 6 | 6 | 3 |
| PRD 3 | 26PPRD81 | Project Phase- II | 0 | 0 | 14 | 14 | 7 |

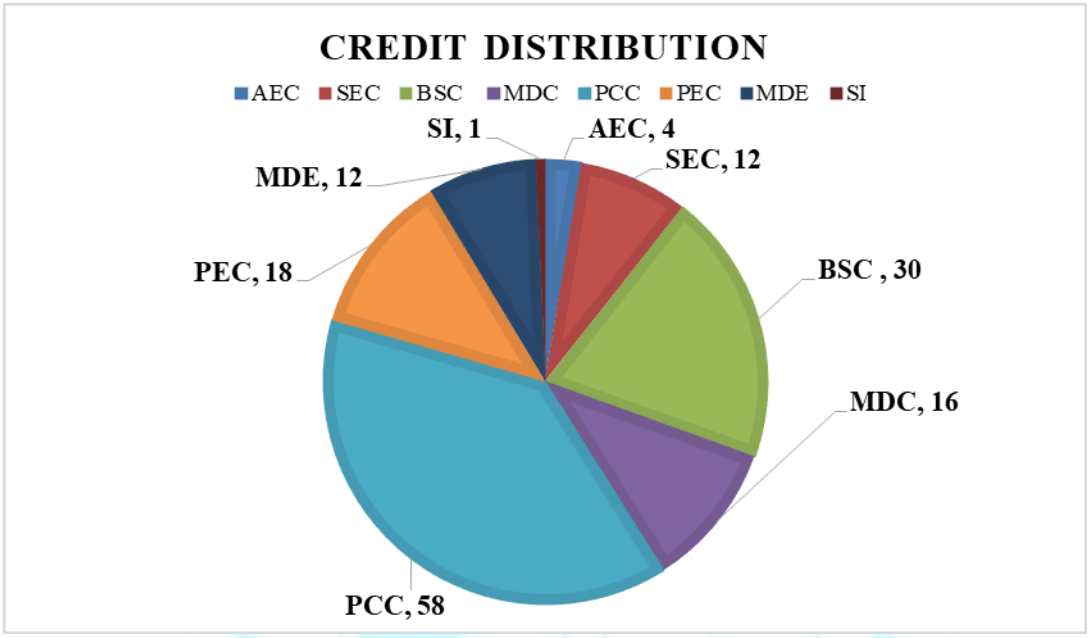
# CREDIT DISTRIBUTION

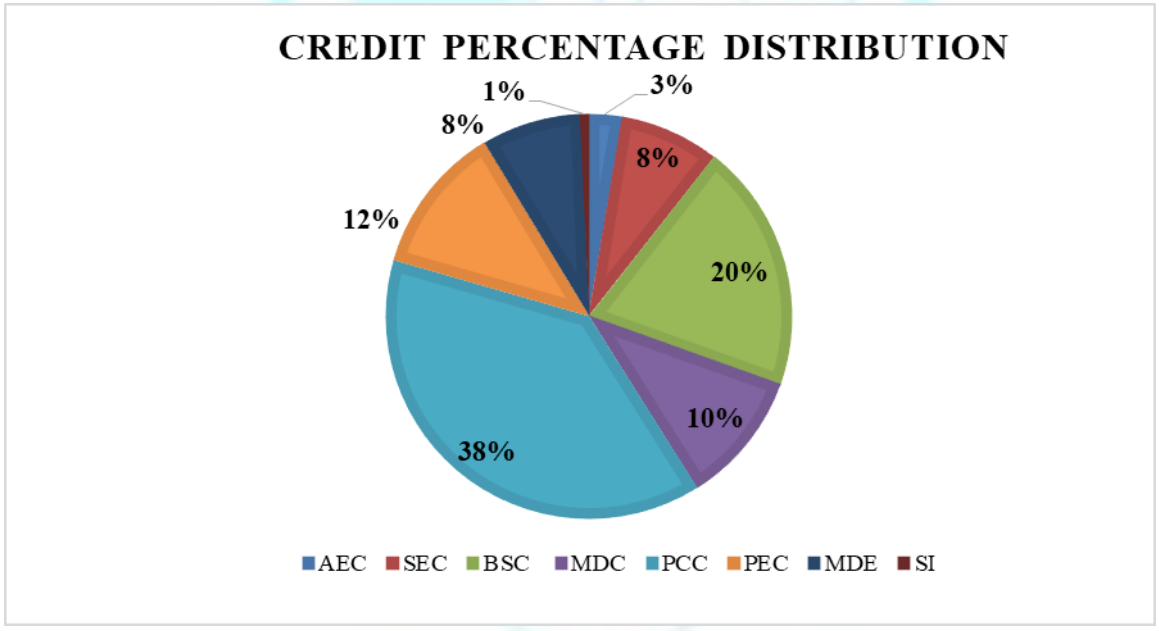
## B.Tech Biomedical Engineering

## Minimum credits to be earned: 165

| Component | I Sem | II Sem | III Sem | IV Sem | V Sem | VI Sem | VII Sem | VIII Sem | 4 Yrs Total Credits |
|---|---|---|---|---|---|---|---|---|---|
| AEC | - | 3 | - | - | - | - | 1 | - | 4 |
| SEC | - | - | 4 | 3 | 2 | 2 | 1 | - | 12 |
| BSC | 8.5 | 8.5 | 7 | 4 | 2 | - | - | - | 30 |
| MDC | 4.5 | 8.5 | - | 3 | - | - | - | - | 16 |
| PCC | 4 | - | 10.5 | 13 | 12.5 | 10 | 8 | - | 58 |
| PEC | - | - | - | - | 3 | 6 | 6 | 3 | 18 |
| MDE | - | - | - | - | 3 | 3 | 3 | 3 | 12 |
| SI | - | - | - | - | - | 1 | - | - | 1 |
| PRD | - | - | - | - | 1 | - | 3 | 7 | 11 |
| VAC | 3 | - | - | - | - | - | - | - | 3 |
| Total Credits | 20 | 20 | 21.5 | 23 | 23.5 | 22 | 22 | 13 | 165 |

# CREDIT DISTRIBUTION



# SEMESTER I

# SYLLABUS

| 26GCMA11 | MATHEMATICS-I (CALCULUS AND LINEAR ALGEBRA) | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 | 4 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | |

**COURSE OBJECTIVES**

- To build knowledge in differential, integral and multivariable calculus for solving engineering and scientific problems.
- To impart fundamental concepts of matrices, vector spaces, eigenvalues, eigenvectors and linear transformations used in engineering applications.
  To provide a strong mathematical foundation for advanced studies in mathematics, data science and engineering disciplines.

| UNIT I | CALCULUS | 12 Hours |
|---|---|---|

Rolle's theorem-Mean value theorems-Taylor's and Maclaurin theorems -Indeterminate forms and L'Hospital's rule-Curvature – cartesian and polar coordinates – Circle of curvature – Involutes and Evolutes – Envelopes –properties of envelopes – Evolute as envelope of normals.

| UNIT II | SEQUENCES AND SERIES AND MULTIVARIABLE CALCULUS | 12 Hours |
|---|---|---|

Limits of sequence of numbers, Calculation of limits, Infinite series, Tests for convergence, Power series, Taylor and Maclaurin series.
Limit continuity, partial derivatives and total derivative, Jacobian-Functional dependence and Independence, Maxima and minima and saddle points, Method of Lagrange multipliers.

| UNIT III | INTEGRAL CALCULUS (MULTIPLE INTEGRALS) | 12 Hours |
|---|---|---|

Introduction - Double integrals- triple integrals- change of order of integration-change of variables to polar- cylindrical and spherical coordinates-Finding areas (by double integrals) and volumes (by double integrals and triple integrals)

| UNIT IV | MATRICES | 12 Hours |
|---|---|---|

Introduction, -Types of matrices. Rank of a matrix - echelon form, normal form, consistency system of linear equations (Homogeneous and Non-Homogeneous). Eigen values and Eigen vectors and their properties (without proof), Cayley-Hamilton theorem (without proof),
Diagonalisation

| UNIT V | VECTOR SPACES | 12 Hours |
|---|---|---|

Vector Space- linear Independence and dependence of vectors, basis, dimension- Linear transformations (maps), range and kernel of a linear map, rank and nullity- Inner product spaces-Gram-Schmidt Orthogonalization.

**Total: 60 Hours**

**Self-Learning: 60 Hours**

## TEXT BOOKS:


1. Joel R. Hass, Christopher E. Heil, Maurice D. Weir, Przemysław Bogacki, Thomas' Calculus, 15th Edition, Pearson, 2022.
2. Ramana.B.V, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, First Edition, 2025-26.
3. N.P. Bali and Manish Goyal, A text book of Engineering and Mathematics I, Laxmi Publications, 10th Edition, 2023.


## REFERENCE BOOKS:


1. P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, Pearson India, 2019.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 11th Edition, Wiley India, 2025.
3. Veerarajan T., Engineering Mathematics for First Year, Tata McGraw-Hill, New Delhi, Latest Reprint.
4. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, New Delhi, 2024.


## WEB LINKS:

1. https://www.khanacademy.org/math/multivariable-calculus/applications-of-multivariable-derivatives/optimizing-multivariable-functions/a/maximums-minimums
2. https://www.geeksforgeeks.org/rolles-and-lagranges-mean-value-theorem/
3. https://home.iitk.ac.in/~arlal/MTH102/la.pdf

## NPTEL LINKS:

1. Engineering Mathematics - I , By Prof. Jitendra Kumar | IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ma37/preview

## LIST OF EXPERIMENTS

| Sl.No | List of Experiments |
|---|---|
| 1 | Introduction to Calculus through MATLAB – Symbolic Computations |
| 2 | Plotting and visualising curves and surfaces |
| 3 | Evaluating maxima and minima of functions of several variables |
| 4 | Evaluation of maxima and minima, applying the Lagrange multiplier method |
| 5 | Evaluation of volume under a surface by double Integral |
| 6 | Evaluating triple integrals |
| 7 | Evaluation of Eigenvalues and Eigen vectors |

## TEXT BOOKS:


1. Ronald L. Lipsman , Jonathan M. Rosenberg, Multivariable Calculus with MATLAB with applications to Geometry and Physics, Springe, 2017.


## REFERENCE BOOKS:


1. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press, 2022.


## WEBLINK:

1. https://www.khanacademy.org/math/multivariable-calculus/applications-of-multivariable-derivatives/optimizing-multivariable-functions/a/maximums-minimums
2. https://www.geeksforgeeks.org/rolles-and-lagranges-mean-value-theorem/
3. https://home.iitk.ac.in/~arlal/MTH102/la.pdf

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Apply the principles of differential and multivariable calculus, to solve mathematical problems. | **K3** |
| **CO2** | Analyze sequences, series, and multivariable functions | **K4** |
| **CO3** | Evaluate double and triple integrals for engineering applications | **K5** |
| **CO4** | Solve linear algebra problems using concepts of vector spaces. | **K3** |
| **CO5** | Apply concepts of matrices and vector spaces for solving problems in liner algebra. | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| **CO2** | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 2 | - |
| **CO3** | 3 | 3 | - | 2 | 3 | - | - | - | - | - | - | 2 | - |
| **CO4** | 2 | 3 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| **CO5** | 3 | 2 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| **AVG** | **2.6** | **2.6** | **-** | **2** | **3** | - | - | - | - | - | - | **2** | - |

| 26CBPH11 | PHYSICS - OSCILLATIONS, WAVES AND OPTICS | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 3 | 0 | 0 | 3 | 3 |
| PRE-REQUISITE | NIL | CO-REQUISITE | PHYSICS-OSCILLATIONS, WAVES AND OPTICS LAB | | | | |

**COURSE OBJECTIVES**

- To learn the fundamentals of oscillations, wave optics, and lasers.
- To apply these fundamental principles to solve practical problems involving optical systems in engineering applications.

| UNIT I | OSCILLATIONS | 9 Hours |
|---|---|---|

Simple harmonic motion: types and characteristics - Harmonic oscillator – Differential equation and solution of simple harmonic oscillator – Simple pendulum – Damped harmonic oscillator Forced vibrations – Free oscillations - Resonance

| UNIT II | NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES | 9 Hours |
|---|---|---|

Waves - Characteristics of a waves: Longitudinal and transverse waves- Acoustic waves Classification of sound waves - Characteristics of musical sound, decibel - Noise pollution- Acoustics of buildings - Reverberation time – Sabine's formula for reverberation time.

| UNIT III | GEOMETRIC OPTICS | 9 Hours |
|---|---|---|

Nature of light – Light as electromagnetic oscillation - Fresnel and Fraunhofer's equations, reflectance and transmittance - Brewster's angle - Total internal reflection – Dispersion - Dispersive power of prism - Defect of lenses - spherical aberration in lens - coma- Achromatic lenses.

| UNIT IV | WAVE OPTICS | 9 Hours |
|---|---|---|

Huygens' Principle - Superposition of waves - Young's double slit experiment- Newton's rings- Michelson interferometer - Mach Zehnder interferometer - Plane diffraction grating - Dispersion power and resolving power of grating.

| UNIT V | LASERS | 9 Hours |
|---|---|---|

Introduction - Properties of laser beams - Einstein's theory of matter radiation interaction and A and B coefficients - Different types of lasers: He-Ne Laser, $CO_2$ Laser and Nd-YAG laser - Applications of lasers in Science, Medicine and Engineering fields.

**Total: 45 Hours**

**Self-Learning: 45 Hours**

**TEXT BOOKS:**

1. Mechanics (Semester I): NEP for the University of Delhi, Dr. P.S. Hemne & D.S. Mathur (2023).
2. A text book of waves and oscillations, Brij Lal and N. Subrahmanyam, Vikas Publishing (2015).
3. Avadhanulu, M. N., Brij Lal, and N. Subrahmanyam. A Textbook of Optics. New Delhi: S. Chand & Company Pvt. Ltd., 2012.

**REFERENCE BOOKS:**

1. E. Hecht, "Optics", Pearson Education, 2017.
2. H. J. Pain, The physics of vibrations and waves, Wiley, 2006.
3. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
4. A. Ghatak, "Optics", McGraw Hill Education, 2012.

5. O. Svelto, “Principles of Lasers”, Springer Science & Business Media, 2010.
6. N.K. Bajaj, “The Physics of Waves and Oscillations”, Tata McGraw-Hill, 1988
7. K. Uno Ingard, “Fundamentals of Waves & Oscillations”, Cambridge University Press, 1988.

**WEB LINKS:**

1. https://nptel.ac.in/courses/115102124
2. https://nptel.ac.in/courses/122106034

**NPTEL LINKS:**

1. Waves and Oscillations, IISER Pune, Prof. M. S. Santhanam, https://nptel.ac.in/courses/115106119
2. Osillation and Wave, IIT Kharagpur, Prof. S.P. Kastagir, Prof. S. Bharadwaj, https://nptel.ac.in/courses/115105083

**COURSE OUTCOMES**

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Analyse the basic concepts of a simple harmonic oscillator. | **K4** |
| **CO2** | Identify the remedies for a building's acoustics. | **K3** |
| **CO3** | Analyse the different types of lens aberrations. | **K4** |
| **CO4** | Distinguish between Fresnel and Fraunhofer diffraction. | **K4** |
| **CO5** | Classify the different types of lasers and their applications. | **K4** |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | - | 2 | 3 | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | - | 3 | - | - | - | - | - | - | 3 | 2 | - |
| **CO4** | 2 | - | 2 | 2 | - | - | - | - | - | - | - | 2 | - |
| **CO5** | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | - |
| **AVG** | **2.60** | **2.75** | **2.66** | **2.33** | **2.50** | - | - | - | - | - | **2.50** | **2** | - |

| 26PBPH11 | PHYSICS -OSCILLATIONS, WAVES AND OPTICS LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 3 | 3 | 1.5 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To enable the student to explore the field of Properties of Matter and Optics.
- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables.

**List of Experiments**

1. Determination of Rigidity Modulus – Torsional pendulum
2. Determination of wavelength and particle size using laser
3. Ultrasonic Interferometer
4. Determination of band gap of a semiconductor material
5. Hooke's law – Determination of spring constant
6. Determination of Young's Modulus – Uniform Bending
7. Determination of Young's Modulus – Non Uniform Bending
8. Determination of Viscosity of a liquid - Poiseuille's method
9. Spectrometer – Grating
10. Deflection Magnetometer - Tan A position
11. Deflection Magnetometer - Tan B position
12. Potentiometer - Calibration of low range Voltmeter

**Total: 45 Hours**

**Self-Learning: 45 Hours**

## TEXT BOOKS:

1. C. C. Ouseph, U. J. Rao, V. Vjiayendran, Practical Physics,1st Edition, 2019.
2. Biswajit Saha, Practical Physics Book, LAP LAMBERT Academic Publishing, 1st Edition, 2020.

## REFERENCE BOOKS:

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

## WEB LINKS:

1. http://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=2
2. https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=1509&cnt=4

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Measure the wavelength and particle size of the semiconductor diode laser. | **K5** |
| **CO2** | Analyse the coefficient of viscosity of a liquid. | **K4** |
| **CO3** | Estimate the band gap energy of the given semiconductor material. | **K5** |
| **CO4** | Determine the compressibility of the liquid using an ultrasonic interferometer | **K5** |
| **CO5** | Measure the Young's modulus of the given solid materials. | **K5** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | - |
| **CO2** | - | - | - | 2 | 2 | 2 | - | - | - | - | - | 2 | - |
| **CO3** | - | - | 3 | 3 | 3 | - | - | - | - | - | - | 3 | - |
| **CO4** | - | - | 2 | 3 | - | 2 | - | - | - | - | - | - | - |
| **CO5** | - | - | 3 | 3 | 2 | - | - | - | - | - | - | 2 | - |
| **AVG** | - | - | **2.75** | **2.80** | **2.50** | **2.33** | - | - | - | - | - | **2.50** | - |

| 26CBBM11 | ANATOMY AND HUMAN PHYSIOLOGY | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 | 4 |

| PRE-REQUISITE | NIL | CO-REQUISITE | NIL |
|---|---|---|---|

**COURSE OBJECTIVES**

- To provide a solid foundation for understanding the structure and function of the human body.
- To learn to the functional aspects of individual organs of the body.
- To explain how body systems function to maintain homeostasis on day-to-day basis through the process of circulation, respiration, digestion, cellular metabolism, urinary functions and buffer systems.

| UNIT I | CARDIOVASCULAR SYSTEM | 12 Hours |
|---|---|---|

Blood, Blood groups, Blood coagulation, structure and function of hemoglobin. Heart - Anatomy of heart; origin, conduction and regulation of heart beat, Cardiac cycle, Electrocardiogram, Blood pressure, regulation of blood pressure.

| UNIT II | DIGESTIVE AND EXCRETORY SYSTEM | 12 Hours |
|---|---|---|

Overview of organs of digestive system-mouth, stomach, Small intestine, large intestine, Liver, Structure of Kidney, Physiology of urine formation, Role of the kidney in the regulation of water.

| UNIT III | ENDOCRINE AND NERVOUS SYSTEM | 12 Hours |
|---|---|---|

Endocrine System - Hormones - Pituitary Gland, Pineal Gland, Thyroid Gland, Pancreas, Adrenal Glands, Neuron, Organization of Nervous System - Brain and Spinal cord, Synapse, Reflex activity

| UNIT IV | RESPIRATORY AND SENSORY SYSTEM | 12 Hours |
|---|---|---|

Physiology of Respiration, Pulmonary Function tests, Exchange and transport of gases in the Blood, Structure of eye and ear, physiology of vision, Mechanism of hearing.

| UNIT V | BONES AND MUSCLE PHYSIOLOGY | 12 Hours |
|---|---|---|

Bones - types, formation, Development and growth of bone, Axial and Appendicular Skeleton, Joints of Skeleton, Types of muscles - Skeletal, Cardiac and Smooth muscle structure. Structure of neuro muscular junction

**Total: 60 Hours**

**Self-Learning: 60 Hours**

## TEXT BOOKS:

1. Ross and Wilson, Anatomy and Physiology in Health and Illness, Churchill Livingstone, 14th Edition, 2022.
2. Arthur C. Guyton & John E. Hall, Text Book of Medical Physiology, W.B.Saunders Company, London, 15th Edition, 2026.
3. Gerard. J. Tortora. Principles of Human Anatomy and physiology, Harper Collins College Publishers, 16th Edition, 2020

## REFERENCE BOOKS:

1. Frederic H. Martini et al., Fundamentals of Anatomy & Physiology, Pearson, 12th Edition (Reprint), 2022.
2. Elaine N. Marieb and Katja Hoehn, Human Anatomy & Physiology, Pearson, 12th Edition (Reprint), 2023

## WEB LINKS:

1. https://www.coursera.org/learn/physiology
2. https://oyc.yale.edu/biomedical-engineering

## NPTEL LINKS:

1. Human Physiology, Prof. Sudip Mukherjee | IIT (BHU) Varanasi https://onlinecourses.nptel.ac.in/noc25_bt50/preview

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| CO1 | Explain the basic structure and functions of human body systems including cells and tissues. | K 2 |
| CO2 | Describe the organization and functional relationships among various organs and organ systems of the human body. | K 2 |
| CO3 | Explain the physiological mechanisms involved in the regulation and coordination of body functions | K 3 |
| CO4 | Analyze the role of different body systems in maintaining normal physiological processes and homeostasis. | K 4 |
| CO5 | Apply the knowledge of human anatomy and physiology to understand healthcare and biomedical engineering applications | K 3 |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| AVG | 3 | 2.4 | - | - | - | - | - | - | - | - | 2 | 3 | - |

| 26CBCE11 | COMPUTER PROGRAMMING USING C | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 | 3 |

| PRE-REQUISITE | NIL | CO-REQUISITE | COMPUTER PROGRAMMING USING C LAB |
|---|---|---|---|

**COURSE OBJECTIVES**

- To equip engineering students with the foundational knowledge and practical skills in 'C' programming to analyse and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

| UNIT I | BASICS OF COMPUTER HARDWARE AND SOFTWARE | 9 Hours |
|---|---|---|

**Basics of Computer Hardware and Software Basics of Computer Architecture:** processor, Memory, Input& Output devices Application Software & System software: Compilers, interpreters, High level and low level languages.

**Introduction to structured approach to programming:** Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, program structure, Compilation & Execution process, Interactive and Script mode, Comments, Indentation, Error messages.

| UNIT II | C PROGRAM BASICS | 9 Hours |
|---|---|---|

**Basic structure of C program:** Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf

**Operators and Expressions:** Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

**Control Flow Statements:** If Statement, Switch Statement, Unconditional Branching using go to statement, While Loop, Do While Loop, For Loop, Break and Continue statements.

| UNIT III | ARRAYS AND STRINGS | 9 Hours |
|---|---|---|

**Arrays:** Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

**String processing:** In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets) Linear search program, bubble sort program, simple programs covering arrays and strings

| UNIT IV | FUNCTIONS | 9 Hours |
|---|---|---|

**Functions :** Introduction to modular programming, writing functions, formal parameters, actual parameters, Call by Value, Call by Reference, Recursion, Arrays as Function Parameters

**Structure & Union :** Structure, union

**Storage Classes :** Scope and life time of variables, simple programs using functions

| UNIT V | POINTERS AND FILES | 9 Hours |
|---|---|---|

**Basics of Pointer:** declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect

**File Operations:** open, close, read, write, append Sequential access and random access to files: In built file handling functions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite()), simple programs covering pointers and files.

**Total: 45 Hours**

**Self-Learning: 45 Hours**

**TEXT BOOKS:**

1. Balagurusamy, E., *Programming in ANSI C*, 9th Edition, McGraw Hill, 2024.

2. Thareja, R., Programming in C, 3rd Edition, Oxford University Press India, 2023.
3. Kamthane, A.N., *Programming in C*, 3rd Edition, Pearson, 2024.

## REFERENCE BOOKS:

1. Kanetkar, Y.P., *Let Us C*, 20th Edition, BPB Publications, 2022.
2. Kernighan, B.W., Ritchie, D.M., *The C Programming Language*, 2nd Edition, Pearson, **1988 (Reprint 2021)**.

## WEB LINKS:

1. Learn-C.org - Learn C - Free Interactive C Tutorial Learn C - Free Interactive C Tutorial
2. GeeksforGeeks - C Programming - https://www.geeksforgeeks.org/c-programming language/
3. GNU C Library Documentation - https://www.gnu.org/software/libc/manual/

## NPTEL LINKS:

1. Problem Solving Through Programming In C" by Prof. Anupam Basu, IIT Kharagpur https://nptel.ac.in/courses/106105171

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Apply algorithms, flowcharts, and pseudocode to design solutions for computational problems. | **K3** |
| **CO2** | Develop C programs using appropriate data types, operators, and control structures to solve basic problems. | **K3** |
| **CO3** | Implement arrays and string operations for efficient data manipulation. | **K4** |
| **CO4** | Design modular programs using functions, recursion, and structured programming concepts. | **K4** |
| **CO5** | Apply pointers and file handling techniques to perform dynamic memory access and data storage operations. | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | – | 2 | – | – | – | – | – | – | 2 | – |
| **CO2** | 3 | 3 | 3 | – | 3 | – | – | – | – | – | – | 2 | – |
| **CO3** | 3 | 3 | - | 2 | 3 | – | – | – | – | – | – | – | – |
| **CO4** | 3 | 2 | 3 | 3 | 2 | – | – | – | – | – | – | – | – |
| **CO5** | 3 | 2 | - | – | 3 | – | – | – | – | – | – | 2 | – |
| **AVG** | **3.0** | **2.6** | **3** | **2.5** | **2.6** | **–** | **–** | **–** | **–** | **–** | **–** | **2** | **–** |

| 26PBCE11 | COMPUTER PROGRAMMING USING C LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 3 | 3 | 1.5 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To provide fundamental knowledge of computer programming concepts and problem-solving techniques using the C programming language.
- To develop the ability to design, implement, and debug C programs using control structures, arrays, functions, pointers, and file handling concepts.
- To enhance logical thinking, modular programming, and computational skills for solving engineering and real-world problems effectively.

**List of Experiments**

. **Basics of C Programming and Decision Making**

1. Basic arithmetic operations using operators.
2. Largest of three numbers using decision-making statements.
3. Even or odd number checking using if–else statement.
4. Leap year checking program.
5. Simple calculator using switch statement.
6. Multiplication table generation using loops.
7. Fibonacci series generation.
8. Factorial of a number using loops and recursion.
9. Prime number checking.
10. Reverse and palindrome number checking.

**II. Arrays and Strings**

0. Sum, average, largest, and smallest element in a one-dimensional array.
0. Linear search and bubble sort using arrays.
0. Matrix addition and matrix multiplication using two-dimensional arrays.
0. String operations using built-in string handling functions.
0. Counting vowels, consonants, digits, and spaces in a string.

**III. Functions, Structures, and Pointers**

0. Functions demonstrating Call by Value and Call by Reference.
0. Recursive function to find the GCD of two numbers.
1. Structures and unions for storing and displaying student details.
2. Pointer operations including swapping numbers and array access using pointers.

**IV. File Handling**

20. File handling operations including create, read, write, append, copy, and random access functions.

**Total: 45 Hours**

**Self-Learning: 45 Hours**

## TEXT BOOKS:

1. Balagurusamy, E., *Programming in ANSI C*, 9th Edition, McGraw Hill, 2024.
2. Kamthane, A.N., *Programming in C*, 3rd Edition, Pearson, 2024.

## REFERENCE BOOKS:

1. Kanetkar, Y.P., *Let Us C*, 20th Edition, BPB Publications, 2022.
2. Deitel, P. and Deitel, H., *C How to Program*, 9th Edition, Pearson Education, 2022.
3. Kernighan, B.W., Ritchie, D.M., *The C Programming Language*, 2nd Edition, Pearson, **1988 (Reprint 2021)**.

## WEB LINKS:

1. Learn-C.org - Learn C - Free Interactive C Tutorial Learn C - Free Interactive C Tutorial
2. GeeksforGeeks - C Programming - https://www.geeksforgeeks.org/c-programming language/
3. GNU C Library Documentation - https://www.gnu.org/software/libc/manual/

## NPTEL LINKS:

1. Problem Solving Through Programming In C" by Prof. Anupam Basu, IIT Kharagpur https://nptel.ac.in/courses/106105171

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Design algorithms, flowcharts, and structured C programs to solve computational problems. | **K4** |
| **CO2** | Develop C programs using data types, operators, control structures, and looping constructs for problem-solving applications. | **K4** |
| **CO3** | Evaluate array and string operations for efficient data manipulation and processing. | **K5** |
| **CO4** | Design modular and reusable programs using functions, recursion, structures, unions, and pointers. | **K5** |
| **CO5** | Develop applications using pointers and file handling concepts for efficient memory management and data processing. | **K5** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | – | – | 2 | – | – | – | – | – | – | 2 | – |
| **CO2** | 3 | – | 3 | – | 3 | – | – | – | – | – | – | 2 | – |
| **CO3** | 3 | 3 | – | 3 | 3 | – | – | – | – | – | – | – | – |
| **CO4** | 3 | – | 3 | 2 | 3 | – | – | – | – | – | – | – | – |
| **CO5** | – | 2 | – | 3 | 3 | – | – | – | – | – | – | 2 | – |
| **AVG** | **3.0** | **2.6** | **3.0** | **2.6** | **2.8** | – | – | – | – | – | – | **2** | **-** |

| 26EVAC11 | UNIVERSAL HUMAN VALUES (Understanding Harmony) | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 3 | 0 | 0 | 3 | 3 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To understand the need, significance, and process of value education for achieving continuous happiness and prosperity in human life.
- To develop self-exploration and right understanding about harmony within oneself, including the relationship between the self ('I') and the body.
- To analyse and appreciate harmony in family, society, nature, and existence through mutual trust, respect, and coexistence.
- To apply holistic human values and ethical principles in professional life for developing socially responsible and eco-friendly technologies and management practices.

| UNIT I | COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS | 9 Hours |
|---|---|---|

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

| UNIT II | UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF | 9 Hours |
|---|---|---|

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

| UNIT III | UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP | 9 Hours |
|---|---|---|

Understanding harmony in the Family- the basic unit of human interaction, Understanding values in a human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha* )- from family to world family!.

| UNIT IV | UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE | 9 Hours |
|---|---|---|

| | | |
|---|---|---|
| Understanding the harmony in Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence | | |
| **UNIT V** | **IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS** | **9 Hours** |
| Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for the transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations. | | |

**Total: 45 Hours**

**Self-Learning: 45 Hours**

## TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics Excel Books, New Delhi, 2023.

## REFERENCE BOOKS:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins,USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs,Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Explain the importance of value education, self-exploration, and human aspirations for achieving happiness and prosperity. | **K2** |
| **CO2** | Analyze harmony within the human being by understanding the relationship between self ('I') and body, practice self-discipline and healthy living. | **K4** |
| **CO3** | Demonstrate understanding of human relationships, family values, trust, respect, and social harmony for peaceful coexistence. | **K3** |
| **CO4** | Interpret the interconnectedness and mutual fulfillment among human beings, nature, and existence from a holistic perspective. | **K2** |
| **CO5** | Apply ethical human values and professional ethics in engineering, technology, and management practices. | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 2 | - | 3 | - | - | - | - | - |
| CO2 | - | - | - | - | - | 2 | - | 3 | - | - | - | - | - |
| CO3 | - | - | - | - | - | 3 | 2 | 3 | - | - | - | - | - |
| CO4 | - | - | - | - | - | 3 | 3 | 3 | - | - | - | - | - |
| CO5 | - | - | - | - | 2 | 2 | 2 | 3 | - | - | - | - | - |
| AVG | - | - | - | - | **2** | **2.5** | **2.3** | **3** | - | - | - | - | - |

| 26MCID11 | IDEA LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 2 | 2 | 0 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To provide practical exposure to modern fabrication tools, rapid prototyping techniques and digital manufacturing processes.
- To develop skills in electronic circuit design embedded systems programming and integration of hardware and software.
- To encourage innovation, creativity, problem solving and teamwork through mini projects and capstone project implementation.
- To improve technical communication, project documentation and presentation skills through project reporting and demonstrations

**List of Experiments**

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3- or 6-mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood/MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of CNC Milling and CNC router.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

**Total: 30 Hours**

**Self-Learning: 30 Hours**

## TEXT BOOKS:


1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd. 2023
2. Workshop/ Manufacturing Practices (with Lab Manual), Khanna Book Publishing. 2022


## REFERENCE BOOKS:


1. Ulrich and Eppinger, Product Design and Development, 7th Edition, McGraw Hill, 2020.
2. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
3. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen, 2017.
4. Programming Arduino: Getting Started with Sketches, 2nd edition, Simon Monk, McGraw Hill, 2022.

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| CO1 | Demonstrate a comprehensive understanding of the tools, equipment, safety procedures and inventory associated with the IDEA Lab | K2 |
| CO2 | Apply ideation and creative thinking techniques to generate innovative solutions for engineering design challenges and real-world problems | K3 |
| CO3 | Develop practical skills in mechanical and electronic fabrication processes through hands-on experience with machines, tools, embedded systems and manufacturing techniques | K3 |
| CO4 | Develop innovative products by integrating user requirements, market needs and technological advancements into the product development process | K4 |
| CO5 | Apply iterative design methodologies to analyze, refine and improve engineering solutions based on testing, evaluation, feedback and usability considerations | K4 |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | 3 | - | - | - | - | - | - | - | - |
| CO2 | 2 | 3 | 3 | - | 2 | - | - | - | - | 2 | - | 3 | - |
| CO3 | 3 | 2 | 3 | - | 3 | - | - | - | - | 2 | - | 2 | - |
| CO4 | 2 | 3 | 3 | - | 3 | - | - | - | - | 2 | - | 2 | - |
| CO5 | 2 | 3 | 3 | - | 2 | - | - | - | - | 2 | - | 2 | - |
| AVG | **2.2** | **2.7** | **3** | - | **2.6** | - | - | - | - | **2** | - | **2.25** | - |

# SEMESTER II

# SYLLABUS

| 26GCCH21 | ENGINEERING CHEMISTRY | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 | 3 |

| PRE-REQUISITE | NIL | CO-REQUISITE | ENGINEERING CHEMISTRY LAB |
|---|---|---|---|

**COURSE OBJECTIVES**

- To gain knowledge of molecular orbitals, ionic interactions, and periodic trends.
- To analyze periodic properties, including ionization energy, electronegativity, and oxidation states.
- To outline the key chemical reactions involved in molecular synthesis.

| UNIT I | PERIODIC PROPERTIES OF ELEMENTS | 9 Hours |
|---|---|---|

Introduction to Periodic Properties- Modern periodic law, Classification of elements, variation of s, p, d and f-block elements - orbital energies of atoms in the periodic table, Effective nuclear charge, penetration of orbitals. Atomic and Ionic Radii, Ionization Energy, Electron Affinity, Electronegativity - Definition - Scales of electronegativity (Pauling scale – qualitative) - Valency and Oxidation States, Periodic variation of properties.

| UNIT II | SPECTROSCOPIC TECHNIQUES AND APPLICATIONS | 9 Hours |
|---|---|---|

Interaction of electromagnetic radiation with matter - Types of spectra: absorption and emission - Regions of electromagnetic spectrum. Principles of spectroscopy and selection rules. Electronic transitions - Beer–Lambert law - Principle of UV–Visible spectroscopy - Instrumentation and working of UV spectrophotometer and its applications. Fluorescence and phosphorescence- Importance and applications. Rotational spectroscopy of diatomic molecules and Vibrational Spectroscopy, Instrumentation and working of IR spectrophotometer. Applications.

| UNIT III | THERMODYNAMICS, ELECTROCHEMISTRY AND CORROSION | 9 Hours |
|---|---|---|

Thermodynamic functions: energy, entropy, free energy. Free energy and emf. Cell potentials, the Nernst equation and its applications. Electrochemical and electrolytic cells – primary and secondary batteries. Fuel cells: $H_2$-$O_2$fuel cell- photovoltaic cell - Solar cells. Water Quality parameters, Water Treatment – Demineralization Process– Reverse osmosis process. Corrosion – Wet and Dry Corrosion, Methods of Corrosion Control – Sacrificial anodic protection and impressed current cathodic Protection methods.

| UNIT IV | ATOMIC AND MOLECULAR STRUCTURE, COORDINATION CHEMISTRY | 9 Hours |
|---|---|---|

Molecular orbital diagrams of diatomic molecules. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Ionic, dipolar and van Der Waals interactions, Band structure of solids and the role of doping on band structures. Coordination numbers and geometries, hard soft acids and bases, molecular geometries.

| UNIT V | ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE | 9 Hours |
|---|---|---|

Introduction to Organic Reactions - Classification of organic reactions - Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, Coupling reaction and ring openings. Synthesis of a commonly used drug molecule - Stepwise synthesis of Aspirin / Paracetamol / Ibuprofen

**Total: 45 Hours**

**Self-Learning: 45 Hours**

## TEXT BOOKS:

1. Engineering Chemistry, by PrasantaRath, B, Rama Devi, C H Venkata Ramana Reddy, Subendu Chakraborthy, Cengage Learning Publication India Private Limited, Edition 2018.
2. Engineering Chemistry, Jain & Jain, 16th Edition, 2018.
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

## REFERENCE BOOKS:

1. B R Puri, L R Sharma and M S Pathania, Principles of Physical Chemistry, S. Nagin Chand & Company Ltd, 49th edition 2025
2. Atkins' Physical Chemistry: International, 2018, Eleventh edition, Oxford University Press; UK.
3. Colin Banwell, Elaine McCash, Fundamentals for Molecular Spectroscopy, 4th Edition, McGraw Hill, 2016 US
4. Solid State Chemistry and its Applications, Anthony R. West. 2022, 2nd edition, Wiley, UK

## WEB LINKS:

1. https://opentextbc.ca/chemistry/chapter/10-1-intermolecular-forces/
2. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf
3. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/ Chemical_Energetics/FreeEnergyandEquilibrium
4. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/ Descriptive_Chemistry/ Periodic_Trends_of_Elemental_Properties/Periodic_Properties_of_the_Elements
5. https://www.bcebhagalpur.ac.in/wp-content/uploads/2020/03/Organic-Reactions-Synthesis-of-Drug- Molecule.pdf

## NPTEL LINKS:

1. Concepts of Chemistry for Engineering By Prof. Anindya Datta, Prof. Debabrata Maiti, Prof. Chidambar Kulkarni, Prof. Arnab Dutta, IIT Bombay https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cy48

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Explain the periodic trends in atomic and molecular properties, including chemical properties and oxidation states of elements. | **K2** |
| **CO2** | Apply the fundamental principles of spectroscopic techniques to determine molecular structure, bonding, and material characteristics. | **K3** |
| **CO3** | Illustrate the concepts of chemical equilibrium using thermodynamic functions, electrochemical cells, and corrosion processes. | **K3** |
| **CO4** | Explain the principles of atomic and molecular structure, including molecular orbital theory, crystal field theory, band structure, and the electronic structure of solids. | **K2** |
| **CO5** | Demonstrate the fundamental organic reaction mechanisms and synthetic strategies for the preparation of a commonly used drug molecule. | **K2** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | - | 2 | - | - | 2 | - | - | - | - | - | - |
| CO3 | 3 | 3 | - | 2 | - | 2 | 2 | - | - | - | - | - | - |
| CO4 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 2 | - | - | 2 | 2 | - | - | - | - | - | - |
| AVG | 2.6 | 2.2 | 2.0 | 2.0 | - | 2.0 | 2.0 | - | - | - | - | - | - |

| 26GPCH21 | ENGINEERING CHEMISTRY LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 3 | 3 | 1.5 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To analyze water and solution quality using chemical methods such as alkalinity, hardness, and chloride determination.
- To apply electrochemical techniques including conductometry, potentiometry and pH-metry for precise measurements.
- To investigate kinetics and adsorption through experiments on reaction rate constants and adsorption studies.

**List of Experiments**

1. Determination of type and amount of alkalinity present in the given water sample.
2. Determination of strength of the given acid by pH metry.
3. Determination of the amount of strong acid present in the given solution by conductometric titration.
4. Determination of mixture of acids by conductometric method.
5. Determination of cell constant and conductance of solution.
6. Estimation of amount of ferrous ion present in the whole of the given solution by Potentiometric method.
7. Estimation of the amount of chloride present in the water sample by Argentometric analysis.
8. Determination of total, temporary and permanent hardness of the given water sample by EDTA method.
9. Determination of the rate constant of a reaction.
10. Estimation of adsorption of acetic acid by charcoal.

**Total: 45 Hours**

**Self-Learning: 45 Hours**

**TEXT BOOKS:**


1. Dr. Sunita Rattan Engineering Chemistry (With Experiments) ,published by S.K. Kataria& Sons 2024.
2. Dr. N. Rama Jyothi, Engineering Chemistry Lab Manual, Shine Book Publishing, 2023
3. .Sundaramand K.Raghavan "PracticalChemistry", S.Viswanathan. Co.3rd edition 2011.
4. Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual"S. Viswanathan Pvt. Ltd 3rd edition 2011.


**REFERENCE BOOKS:**


1. Vogel's– "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011
2. J.N.GurtuandR.Kapoor "Advanced experimental Chemistry", S.Chand and Co 6th edition, 2010.


**WEB LINKS:**

1. https://www.khanacademy.org/science/ap-chemistry-beta/x2eef969c74e0d802:kinetics/x2eef969c74e0d802:introduction-to-rate- law/v/experimental-determination-of-rate-laws
2. https://www.youtube.com/watch?v=qdmKGskCyh8
3. https://www.youtube.com/watch?v=7_6_dKlo67k

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Explain the principles of volumetric and instrumental analytical methods used in chemical analysis. | **K2** |
| **CO2** | Interpret the experimental data obtained from pH-metric, conductometric, and potentiometric techniques. | **K3** |
| **CO3** | Apply analytical methods to determine water quality parameters such as alkalinity, hardness, and chloride content. | **K3** |
| **CO4** | Analyze the reaction kinetics of a reaction using the experimentally generated kinetic data. | **K3** |
| **CO5** | Determine the adsorption parameters of acetic acid on charcoal through adsorption studies. | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | 3 | - | - | - | - | - | - |
| **CO4** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| **AVG** | **2.6** | **2.4** | **2.0** | **2.5** | **-** | **-** | **2.5** | - | - | - | - | - | - |

| 26CBMA21 | MATHEMATICS-II TRANSFORMS AND BOUNDARY VALUE PROBLEMS | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 | 4 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | |

**COURSE OBJECTIVES**

- To understand the principles of Fourier series and Fourier transforms for analysing mathematical and engineering problems.
- To apply analytical methods for solving partial differential equations and boundary value problems arising in engineering.
- To acquire knowledge of Z-transforms and difference equations for modelling discrete systems and applications.

| UNIT I | FOURIER SERIES | 12 Hours |
|---|---|---|

Introduction- Dirichlet's conditions – Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

| UNIT II | FOURIER TRANSFORMS | 12 Hours |
|---|---|---|

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

| UNIT III | PARTIAL DIFFERENTIAL EQUATIONS | 12 Hours |
|---|---|---|

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions; solutions of partial differential equations; equations solvable by direct integration; first-order partial differential equations—linear equations, Lagrange's linear equation, second-order partial differential equations in two independent variables—classification and reduction to canonical forms; applications to Laplace equation in Cartesian and polar coordinates, Cauchy problem, d'Alembert's solution, domains of dependence and influence.

| UNIT IV | APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS | 12 Hours |
|---|---|---|

Classification of PDE — Method of separation of variables — Fourier Series Solutions of one-dimensional wave equation — One-dimensional equation of heat conduction — Steady state solution of two-dimensional equation of heat conduction

| UNIT V | Z TRANSFORMS AND DIFFERENCE EQUATIONS | 12 Hours |
|---|---|---|

Introduction- properties –.z-transform-definition, Standard z-transforms, Damping and shifting rules, problems - Inverse z-transform. Difference equations- Formation of difference equations- Solution of difference equations using Z- transform- applications to solve difference equations.

**Total: 60 Hours**

**Self-Learning: 60 Hours**

**TEXT BOOKS:**


1. Grewal. B.S, *"Higher Engineering Mathematics"*, Khanna Publications, Delhi, 45th Edition, 2024.
2. Manglik. Rohit, "Transforms and Partial Differential Equations", EduGorilla Publication, 1st Edition, 2023.
3. Ratha Jeyalakshmi. R, Meena Kumari. A, Deepalakshmi. J, Vetriselvi. S, Chandrasekar. R, "Engineering Mathematics (including Transforms & PDE)", Cengage India, 1st Edition, 2024.

## REFERENCE BOOKS:


1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 11th Edition, 2025.
2. Veerarajan. T, "Transforms and Partial Differential Equations", McGraw Hill Education India, 3rd Edition, Reprint 2019.
3. Das. P. Sivaramakrishna & Vijayakumari. C, "Engineering Mathematics (Transforms & PDE)", Pearson Education India, 6th Edition, Reprint 2019.


## WEB LINKS:

1. http://.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. http://www.bookstreet.in

## NPTEL LINKS:

1. Mathematics III-Fourier Analysis and its applications, IIT Bombay-Prof.G.K.Srinivasen https://nptel.ac.in/courses/111101164

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Interpret Fourier series and transform techniques. | **K2** |
| **CO2** | Apply Fourier series and transforms in solving functional problems. | **K3** |
| **CO3** | Examine partial differential equations using appropriate transform techniques | **K4** |
| **CO4** | Evaluate wave and heat transfer problems in engineering systems | **K4** |
| **CO5** | Apply Z-transform techniques and their properties for solving difference equations | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| **CO2** | 3 | 3 | 2 | - | 2 | - | - | - | - | - | - | 2 | - |
| **CO3** | 3 | 3 | 2 | - | 3 | - | - | - | - | - | - | 2 | - |
| **CO4** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 2 | - |
| **CO5** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| **AVG** | **3** | **2.8** | **2.33** | **2** | **2.75** | - | - | - | - | - | - | **2** | - |

| 26CBEE21 | FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS SCIENCES | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 | 3 |

| PRE-REQUISITE | NIL | CO-REQUISITE | FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS SCIENCES LAB |
|---|---|---|---|

**COURSE OBJECTIVES**

- To impart the foundational concepts of electrical circuits and digital electronics in various applications

| UNIT I | DC FUNDAMENTALS | 9 Hours |
|---|---|---|

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Current Division rule, Voltage Division rule, Source transformation – Kirchoff's laws, node voltage and mesh current methods, Delta-star and star delta conversion, Superposition principle, Thevenin's and Norton's theorems.

| UNIT II | AC FUNDAMENTALS | 9 Hours |
|---|---|---|

Sinusoids and phasor relationships, Impedance and Admittance; sinusoidal steady-state analysis; AC power analysis- Instantaneous and average power, RMS, apparent and PF, complex power.

| UNIT III | FUNDAMENTALS OF ELECTRICAL MACHINES | 9 Hours |
|---|---|---|

DC motor - Construction– principle of operation – torque equation – types – electrical & mechanical characteristics–starting – speed control – various testing – braking. Transformers – principle of operation – types – basic construction – equivalent circuit - regulation and efficiency – auto transformer.

| UNIT IV | SOURCES OF ENERGY | 9 Hours |
|---|---|---|

General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables, Steam, Hydel, Gas and Nuclear power generation. Renewable Energy: Solar and Wind.

| UNIT V | BASIC SEMICONDUCTOR DEVICES | 9 Hours |
|---|---|---|

PN junction diode- construction and operation, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Breakdown in PN Junction Diodes Applications- Rectifiers, Limiting and Clamping Circuits, Zener diode-construction and VI characteristics. Design and Experimental Verification of Diode Characteristics (PN and Zener) and applications (Rectifiers and Voltage Regulators).

**Total: 45 Hours**

**Self-Learning: 45 Hours**

**TEXT BOOKS:**

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, 4th Edition,Tata McGraw Hill, 2025.
2. B.L. Theraja & A.K. Theraja, A Textbook of Electrical Technology (Vol. I), S. Chand Publishing, 2024.
3. V.K. Mehta & Rohit Mehta, Principles of Electrical Engineering, S. Chand Publishing, 2023.

## REFERENCE BOOKS:


1. E. Hughes, Electrical and Electronic Technology, 12th Edition, Pearson Education, 2023.
2. Charles K. Alexander & Matthew N.O. Sadiku, Fundamentals of Electric Circuits,
3. 7th Edition, McGraw Hill Education, 2023.
4. Schaum's Outline Series, Basic Electrical Engineering, 3rd Edition, McGraw Hill, 2024.
5. J.B. Gupta, Fundamentals of Electrical Engineering, Kataria & Sons, 2023.
6. S. Salivahanan & N. Suresh Kumar, Basic Electrical and Electronics Engineering, 2nd Edition, McGraw Hill Education, 2024


## WEB LINKS:

1. https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/#features
2. https://www.wolframalpha.com/examples/society-and-culture/economic-data/energy-data/energy-resources/

## NPTEL LINKS:

1. Fundamentals of Electrical Sciences by Prof. Debapriya Das, IIT Kharagpur https://nptel.ac.in/courses/108105112

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| CO1 | Apply electrical laws and network theorems to solve DC circuits using various methods and transformations. | K3 |
| CO2 | Analyze AC circuits using phasors, impedance concepts and power parameters under sinusoidal steady-state conditions. | K4 |
| CO3 | Explain the construction, working principles, and performance characteristics of DC machines and transformers. | K2 |
| CO4 | Describe the structure and operation of power systems in conventional and renewable energy sources. | K2 |
| CO5 | Understand the operation and characteristics of semiconductor devices in practical circuits. | K2 |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | 2 | - | - | - | - | - | - | 2 | - |
| CO2 | 3 | 3 | - | - | 2 | - | - | - | - | - | - | 2 | - |
| CO3 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | 2 | - |
| CO4 | 2 | 2 | - | - | - | 3 | 2 | - | - | - | - | 2 | - |
| CO5 | 3 | - | - | - | 3 | - | - | - | - | - | - | 2 | - |
| **AVG** | **2.8** | **2.5** | **-** | **-** | **2.25** | **3** | **2** | **-** | **-** | **-** | **-** | **2** | **-** |

| 26PBEE21 | FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS SCIENCES LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 3 | 3 | 1.5 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- Understand and verify the fundamental laws and theorems of electrical circuits through laboratory experiments.
- Investigate the performance and operating characteristics of electrical machines and transformers through load and performance tests.
- Study the characteristics and applications of basic electronic devices, including PN junction diodes, Zener diodes, and rectifier circuits.

**List of Experiments**

1. Verification of Ohm's law and Kirchhoff's laws.
2. To measure single phase power by using three ammeter method.
3. To measure the single-phase power by using three voltmeter method
4. VI characteristics of PN junction and Zener diode
5. Implementation of Half wave and Full wave rectifier
6. Load Test on Single phase transformer
7. O.C and S.C Test on Single phase transformer
8. Load test on DC Shunt motor
9. Load test on DC series motor
10. Swinburne's test

**Total: 45 Hours**

**Self-Learning: 45 Hours**

**TEXT BOOKS:**

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, 4th Edition,Tata McGraw Hill, 2025.

**REFERENCE BOOKS:**

1. E. Hughes, *Electrical and Electronic Technology*, 12th Edition, Pearson Education, 2023.
2. Schaum's Outline Series, *Basic Electrical Engineering*, 3rd Edition, McGraw Hill, 2024.
3. J.B. Gupta, *Fundamentals of Electrical Engineering*, Kataria & Sons, 2023

**WEB LINKS:**

1. https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/#features
2. https://www.wolframalpha.com/examples/society-and-culture/economic-data/energy-data/energy-resources/

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Realize the electrical safety precautions | **K2** |
| **CO2** | Apply fundamental circuit theorems to solve DC electrical circuits | **K3** |
| **CO3** | Comprehend the principles of electrical machines. | **K2** |
| **CO4** | Apply electrical laws and network theorems to solve DC circuits using various methods | **K3** |
| **CO5** | Analyse the performance of electrical circuits and machines through experiments. | **K4** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | 3 | 2 | - | - | - | - | - | - | 2 | - |
| **CO2** | 3 | 3 | - | 3 | 2 | - | - | - | - | - | - | 2 | - |
| **CO3** | 3 | 2 | - | 3 | 2 | - | - | - | - | - | - | 2 | - |
| **CO4** | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| **CO5** | 3 | - | - | 3 | 3 | - | - | - | - | - | - | 2 | - |
| **AVG** | **2.8** | **2.5** | **-** | **3** | **2.25** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** |

| 26CBBM21 | COMPUTER PROGRAMMING USING PYTHON | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 3 | 0 | 2 | 4 | 4 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To develop foundational programming skills using Python syntax, control structures, data structures, and problem-solving techniques.
- To apply functions, arrays, exception handling, and modular programming concepts for developing efficient Python applications.
- To build competency in Python libraries, file handling, modules, and packages for data analysis and application development..

| UNIT I | PYTHON BASICS | 12 Hours |
|---|---|---|

Introduction to Python – Python Interpreter and its working – Syntax and Semantics - Variables and Data Types : Numbers, Booleans, Strings - Assignments and Expressions - Precedence Rules, Operators - Interactive vs Script mode Programming - Input and Output Statements - Control Flow Statements

| UNIT II | CORE PYTHON CONCEPTS AND DATA STRUCTURES | 12 Hours |
|---|---|---|

Local Variables and Global Variables - Lists and String Basics - Tuples and Sets - Dictionaries: Basics, Operations, Methods - Accumulation Techniques - Comprehensions (List, Set, Dictionary) - String Manipulation and Operations - Exception Handling.

| UNIT III | ARRAYS AND FUNCTIONS | 12 Hours |
|---|---|---|

Introduction to Arrays - Use of Arrays - Declaration and Usage of Arrays – Two - Dimensional Arrays - Need for Modular Programming - Function Definition and Invocation - Parameter Passing Techniques - Passing Arrays to Functions - Recursion - Python Built-in Functions and Lambda Functions

| UNIT IV | INTRODUCTION TO NUMPY, PANDAS & MATPLOTLIB | 12 Hours |
|---|---|---|

Introduction to NumPy (arrays, indexing, slicing, operations) – Introduction to Pandas (Series, DataFrame, data manipulation, handling missing data) – Introduction to Matplotlib (line, bar, scatter plots, labels)

| UNIT V | FILES, MODULES, AND PACKAGES | 12 Hours |
|---|---|---|

Files and exception: text files - reading and writing files - command line arguments - errors and exceptions - handling exceptions – modules - packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation.

**Total: 60 Hours**

**Self-Learning: 60 Hours**

## TEXT BOOKS:


1. Matthes, E., *Python Crash Course*, 3rd Edition, No Starch Press, **2023**.
2. McKinney, W., *Python for Data Analysis*, 3rd Edition, O'Reilly, **2022**.
3. Sweigart, A., *Automate the Boring Stuff with Python*, 3rd Edition, No Starch Press, **2023**


## REFERENCE BOOKS:


1. Ramalho, L., *Fluent Python*, 2nd Edition, O'Reilly, 2022.
2. Romano, F., *Learn Python Programming*, 4th Edition, Packt, 2023


## WEB LINKS:

1. https://www.python.org/
2. https://www.learnpython.org/
3. https://www.sitepoint.com/python
4. https://realpython.com/

## NPTEL LINKS:

1. The Joy of Computing using Python By Prof. Sudarshan Iyengar IIT Ropar
   https://nptel.ac.in/courses/106106182

## LIST OF EXPERIMENTS:

1. Solving basic problems using arithmetic expressions and operators.
2. Implementation of decision-making statements using if, if-else, and nested if.
3. Development of programs using looping constructs.
4. Programs using list, set, and dictionary comprehensions.
5. Implementation of accumulation techniques for solving simple problems.
6. Programs using NumPy arrays, indexing, and array operations.
7. Data visualization using Matplotlib line, bar, and scatter plots.
8. File handling operations including reading, writing, and appending text files.

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Develop Python programs using syntax, operators, control structures, and data types for problem solving. | **K3** |
| **CO2** | Implement Python data structures such as lists, tuples, sets, dictionaries, and string operations for data manipulation. | **K4** |
| **CO3** | Design modular Python programs using arrays, functions, recursion, lambda functions, and exception handling techniques. | **K4** |
| **CO4** | Utilize NumPy, Pandas, and Matplotlib libraries for data analysis, manipulation, and visualization tasks. | **K3** |
| **CO5** | Develop Python applications using file handling, modules, and packages for efficient data processing and software development. | **K5** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| CO2 | 3 | 2 | - | 3 | 2 | - | - | - | - | - | - | 2 | - |
| CO3 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | - | 2 | - |
| CO4 | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | 2 | - |
| CO5 | 3 | 3 | - | 2 | 3 | - | - | - | - | - | - | 2 | - |
| AVG | **3** | **2.8** | **2.5** | **2.5** | **2.8** | - | - | - | - | - | - | **2** | - |

| 26CENG21 | TECHNICAL ENGLISH | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 2 | 0 | 0 | 2 | 2 |
| PRE-REQUISITE | NIL | CO-REQUISITE | TECHNICAL ENGLISH LAB | | | | |

**COURSE OBJECTIVES**

- To develop students' vocabulary and word formation skills for effective written communication.
- To enhance learners' ability to construct grammatically correct and meaningful sentences.
- To enable students to identify and correct common errors in English usage.
- To improve students' skills in precise, coherent, and context-appropriate writing.
- To train learners in various forms of practical writing, including letters, reports, essays, and comprehension-based responses.

| UNIT I | VOCABULARY BUILDING | 6 Hours |
|---|---|---|

General Vocabulary, Parts of Speech, Nouns--Compound nouns, Pronouns, Adjectives, Synonyms & Antonyms, Prefixes & Suffixes, Homonyms, Homographs & Homophones, Verb Forms, Blending and Clipping

| UNIT II | BASIC WRITING | 6 Hours |
|---|---|---|

Sentences structures - Kinds of sentences, Types of sentences, Clauses and Phrases, Numerical Expressions, Summarizing, Paragraph Writing, Checklist, Definitions, Precise Writing.

| UNIT III | COMMON ERRORS IN ENGLISH | 6 Hours |
|---|---|---|

Pronouns - Relative pronouns, Demonstrative pronouns, Articles, Prepositions, Tenses , Subject-verb Agreement, Misplaced Modifiers, Redundancies, Infinitives & Gerund, Precise writing

| UNIT IV | NATURE AND STYLE OF SENSIBLE WRITING | 6 Hours |
|---|---|---|

Definitions, Numerical Expressions, Precise writing**,** Conversations/ Situational Dialogues, Process description, Recommendation, Information Transfer- Flow chart Bar chart and Pie chart, Letter Writing, Report Writing.

| UNIT V | FUNDAMENTALS OF COMMUNICATION | 6 Hours |
|---|---|---|

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Listening to Debates and panel discussions, Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form. Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Speaking –group discussions, Debates and Expressing opinions through Simulations & Role play. Reading – Reading editorials; and Opinion Blogs.

**Total: 30 Hours**

**Self-Learning: 30 Hours**

**TEXT BOOKS:**

1. Bikramjit Sen, Dr Gurpreet Singh Saund, Communicative English Skills: An Easy Guide. N.p., Notion Press Media Pvt. Limited, 2025.
2. S. Mekala, Geetha R,Contemporary ELT Strategies in Engineering Pedagogy: Theory and Practice. India, Taylor & Francis, 2022
3. Leech, Geoffrey, and Jan Svartvik. *A communicative grammar of English*. Routledge, 2013.

4. MacKenzie, Ian. *Professional English in Use*. Cambridge University Press, 2006.
5. Ibbotson, Mark. *Professional English in Use: Engineering: Technical English for Professionals*. Cambridge University Press, 2009.

## REFERENCE BOOKS:

1. M Saranya & Mrs M Linju,Professional English II. N.p., Notion Press Media Pvt. Limited, 2024.
2. Technical English (English, Sambaiah M, Wiley India Pvt, Ltd, Genre Technology & Engineering , ISBN-9788126551354, 2014 Edition.
3. Tebeaux, Elizabeth. *The emergence of a tradition: Technical writing in the English Renaissance, 1475-1640*. Routledge, 2018.
4. Tyagi, Kavita, and Padma Misra. *Basic technical communication*. PHI Learning Pvt. Ltd., 2011.
5. Olohan, Maeve. *Scientific and technical translation*. Routledge, 2015.

## WEB LINKS:

1. https://ehlion.com/magazine/technical-english/
2. https://www.kkcl.org.uk/pdf/KKCL_Technical_English_for_Engineers_Brochure.pdf

## NPTEL LINKS:

1. English language for Competitive Examinations By Prof. Aysha Viswamohan, IIT Madras
   **https://onlinecourses.nptel.ac.in/noc26_hs74/preview**

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Apply English language skills in listening, speaking, reading, and writing for technical communication. | **K3** |
| **CO2** | Utilize listening skills for academic and professional communication. | **K3** |
| **CO3** | Demonstrate effective speaking skills in English for real-life situations. | **K4** |
| **CO4** | Develop effective writing skills for technical, formal, and professional communication. | **K3** |
| **CO5** | Identify self-learning strategies and learner autonomy for continuous language development. | **K4** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | 2 | 2 | 3 | 2 | - | - | - |
| **CO2** | - | - | - | - | - | - | - | 2 | 3 | - | - | - | - |
| **CO3** | - | - | - | - | - | - | 2 | 3 | 2 | - | - | - | - |
| **CO4** | - | - | - | - | - | - | 2 | - | 3 | 2 | - | - | - |
| **CO5** | - | - | - | - | - | - | - | - | 2 | 2 | 3 | - | - |
| **AVG** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **2.3** | **2.6** | **2** | **3** | **-** | **-** |

| 26PENG21 | TECHNICAL ENGLISH LAB | | L | T | P | SL | C |
|---|---|---|---|---|---|---|---|
| | | | 0 | 0 | 2 | 2 | 1 |
| PRE-REQUISITE | NIL | CO-REQUISITE | NIL | | | | |

**COURSE OBJECTIVES**

- To enable the student to explore the knowledge in communication skills.
- To gain knowledge in the process of Placement Interviews, Group Discussions and other recruitment procedures.
- To teach appropriate pronunciation, word accent, intonation

**List of Experiments**

1. Introduction to English sounds
2. Consonants and vowels
3. Syllable and Stress
4. Intonation
5. Communication Skills
6. Summarizing
7. Report Writing
8. Information Transfer
9. Presentation Skills
10. Group Discussion
11. Letter Writing
12. Cover letter and Resume

**Total: 30 Hours**

**Self-Learning: 30 Hours**

**TEXT BOOKS:**

1. M.Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw-Hill Publishing Company Limited, New Delhi.2005.
2. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
4. Practical English Usage 4th International Edition 2016 by Michael Swan, Oxford Publisher.

**WEB LINKS:**

1. https://onlinemasters.ohio.edu/blog/engineering-communication/
2. https://online.rice.edu/courses/communication-skills-for-engineers-specialization

**COURSE OUTCOMES**

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| CO1 | Analyze listening and written contexts to understand implied meanings and respond appropriately. | K4 |
| CO2 | Apply appropriate pronunciation, stress, and rhythm in oral communication. | K3 |
| CO3 | Interpret written communication in official contexts such as narrative, descriptive, analytical, and report writing. | K2 |
| CO4 | Analyze different genres of texts and evaluate their ideas and methods of oral presentation. | K4 |
| CO5 | Apply suitable communicative strategies to express ideas effectively in discussions, negotiations, and conversations. | K3 |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | - | - | - | - | - | - | - | - | 3 | 2 | - | - | -- |
| CO3 | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | 3 | - | 2 | - | - | - |
| CO5 | - | - | - | - | - | - | - | 3 | - | 2 | - | - | - |
| **AVG** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **2.3** | **2** | **2** | **-** | **-** |

| 26EVAC21 | CONSTITUTION OF INDIA | L | T | P | SL | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 | 0 |

| PRE-REQUISITE | NIL | CO-REQUISITE | NIL |
|---|---|---|---|

**COURSE OBJECTIVES**

- To introduce the basic concepts, features, and structure of the Constitution of India.
- To understand the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties.
- To understand the constitutional provisions related to amendments, emergencies, and local self-government.
- To develop awareness of constitutional values, rights, duties, and democratic governance.

| UNIT I | NATURE, OBJECT AND SCOPE OF THE CONSTITUTION | 6 Hours |
|---|---|---|

Nature, object and scope of Constitutional Law and Constitutionalism – Historical Perspective of the Constitution of India – Salient Features and Characteristics of Constitution of India

| UNIT II | FUNDAMENTAL RIGHTS | 6 Hours |
|---|---|---|

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

| UNIT III | DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES | 6 Hours |
|---|---|---|

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

| UNIT IV | FEDERAL STRUCTURE | 6 Hours |
|---|---|---|

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India

| UNIT V | AMENDMENT AND EMERGENCY PROVISIONS | 6 Hours |
|---|---|---|

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

**Total: 30 Hours**

**Self-Learning: 30 Hours**

**TEXT BOOKS:**


1. Basu, Durga Das, *Introduction to the Constitution of India*, 26th Edition, LexisNexis, New Delhi, 2023.
2. Agarwal, R. C., *Indian Political System*, Revised Edition, S. Chand and Company, New Delhi, 2022.
3. MacIver and Page, *Society: An Introductory Analysis*, Reprint Edition, Macmillan India Ltd., New Delhi, 2023.
4. Sharma, K. L., *Social Stratification in India: Issues and Themes*, Reprint Edition, Rawat Publications, New Delhi, 2023.


**REFERENCE BOOKS:**


1. Mahajan, V. D., *Constitutional Law of India*, Revised Edition, Eastern Book Company, 2022.
2. Seervai, H. M., *Constitutional Law of India*, 4th Edition, Universal Law Publishing, 2015.
3. Sharma, Brij Kishore, *Introduction to the Constitution of India*, 13th Edition, Prentice Hall of India, New Delhi, 2022.
4. Gahai, U. R., *Indian Political System*, Revised Edition, New Academic Publishing House, Jalandhar, 2021.

5. Sharma, R. N., *Indian Social Problems*, Latest Revised Edition, Media Promoters and Publishers Pvt. Ltd., 2022.

## COURSE OUTCOMES

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

| COURSE OUTCOMES | DESCRIPTION | KNOWLEDGE LEVEL |
|---|---|---|
| **CO1** | Explain the basic principles, features, and structure of the Constitution of India. | **K2** |
| **CO2** | Describe the rights, duties, and responsibilities of Indian citizens under the Constitution. | **K2** |
| **CO3** | Explain the role of constitutional provisions in governance and administration. | **K2** |
| **CO4** | Describe the functioning of the provisions related to constitutional amendments and emergencies. | **K3** |
| **CO5** | Apply constitutional knowledge to understand democratic governance and responsible citizenship. | **K3** |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | P O4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | 2 | 3 | 2 | - | - | 2 | - | - |
| **CO2** | - | - | - | - | - | 3 | 3 | 2 | - | - | 2 | - | - |
| **CO3** | - | - | - | - | - | 3 | 3 | 2 | - | - | 2 | - | - |
| **CO4** | - | - | - | - | - | 3 | 3 | 2 | - | - | 2 | - | - |
| **CO5** | - | - | - | - | - | 3 | 3 | 2 | - | - | 3 | - | - |
| **AVG** | - | - | - | - | - | **2.8** | **3** | **2** | - | - | **2.2** | - | - |