



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



UNDERGRADUATE DEGREE PROGRAMME

B.Tech - Computer Science and Engineering
Specialization with
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

CURRICULUM & SYLLABUS

REGULATIONS 2026

Effective from the Academic Year
2026-2027

Department of Artificial Intelligence & Machine Learning
School of Engineering

PALLAVARAM







DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

VISION OF THE INSTITUTION
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 INSTITUTION	
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	Facilitating appropriate co-curricular, extracurricular and extension activities.
M5	Instilling the spirit of integrity, equity, professional ethics and social harmony.

Web Link:

https://vistas.ac.in/b-tech-cse-in-artificial-intelligence-machine-learning/

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

VISION OF THE DEPARTMENT
To become a center of excellence in Artificial Intelligence and Machine Learning by nurturing innovation, advancing research, and transforming society through intelligent, ethical, and sustainable technological solutions.

MISSION OF THE DEPARTMENT	
M1	To provide a strong foundation in Artificial Intelligence and Machine Learning through quality education in mathematics, computing principles, algorithms, and intelligent system design.
M2	To promote innovation, research, and interdisciplinary learning for developing AI-based solutions that address societal and real-world challenges.
M3	To equip students with practical competency in modern AI technologies, programming platforms, data analytics, and problem-solving through experiential learning.
M4	To nurture ethical values, leadership qualities, lifelong learning, and collaborative engagement with industry, academia, and research organizations for global competence and professional excellence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	
PEO1	Demonstrate proficiency in applying Artificial Intelligence and Machine Learning concepts to develop real-world solutions, as evidenced through successful completion of industry-relevant projects, internships, or professional certifications.
PEO2	Achieve professional success through employment in reputed organizations, pursuit of higher education, and entrepreneurial ventures while demonstrating leadership, innovation, and continuous professional growth.

PEO3	Engage in research, innovation, and development activities in Artificial Intelligence and Machine Learning, demonstrated through publications, patents, funded projects, or participation in technical competitions.
PEO4	Exhibit ethical practices, social responsibility, and commitment to lifelong learning, as evidenced by involvement in community-oriented projects, adherence to professional standards, and continuous upskilling or participation in professional bodies.

PROGRAMME OUTCOMES (PO)	
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4respectively 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. (WK1 to WK4)
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. (WK5)
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. (WK8).
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. (WK2 and WK6)
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. (WK1, WK5, and WK7).
PO7	**Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity
PO8	**Individual and Collaborative Team work:** 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-Long Learning:** Recognize the need for, and have the preparation and ability for i)independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

KNOWLEDGE AND ATTITUDE 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 (PSO)	
PSO1	Demonstrate the ability to develop, deploy, and analyze Artificial Intelligence and Machine Learning solutions using appropriate techniques and tools to solve real-world problems.
PSO2	Design and develop innovative Engineering solutions using emerging technologies and interdisciplinary approaches to meet industrial needs.

COMPETENCIES AND PERFORMANCE INDICATORS
PO 1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to

WK4respectively to develop to the solution of complex engineering problems.			
1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems
		1.1.2	Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
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 engineering fundamentals
1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply theory and principles of computer science and engineering to solve an engineering problem
PO 2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.			
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Evaluate problem statements and identifies objectives
		2.1.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem
		2.1.3	Identify mathematical algorithmic 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 the computer-based system into interconnected subsystems
		2.2.2	Identify functionalities and computing resources.
		2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution/methods to select the best methods

		2.2.5	Compare and contrast alternative solution processes to select the best process.
2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
		2.3.2	Identify design constraints for required performance criteria.
2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Applies engineering mathematics to implement the solution.
		2.4.2	Analyze and interpret the results using contemporary tools.
		2.4.3	Identify the limitations of the solution and sources/causes.
		2.4.4	Arrive at conclusions with respect to the objectives.
PO 3: 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.			
3.1	Demonstrate an ability to define a complex/ open- ended problem in engineering terms	3.1.1	Able to define a precise problem statement with objectives and scope
		3.1.2	Able to identify and document system requirements from stake- holders
		3.1.3	Able to review state-of-the-art literature to synthesize system requirements.
		3.1.4	Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard
		3.1.5	Explore and synthesize system requirements from larger social and professional
		3.1.6	Able to develop software requirement specifications (SRS).
3.2	Demonstrate an ability to generate a diverse set of alternative design	3.2.1	Able to explore design alternatives.
		3.2.2	Able to produce a variety of potential design solutions suited to meet functional requirements.

	solutions	3.2.3	Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.3	Demonstrate an ability to select optimal design scheme for further development	3.3.1	Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
		3.3.2	Consult with domain experts and stakeholders to select candidate engineering
3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Able to refine architecture design into a detailed design within the existing constraints.
		3.4.2	Able to implement and integrate the modules.
		3.4.3	Able to verify the functionalities and validate the design.
PO 4: 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			
4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purposes of investigation, its scope and importance
		4.1.2	Able to choose appropriate procedure/algorithm, dataset and test cases.
		4.1.3	Able to choose appropriate hardware/software tools to conduct the experiment.
4.2	Demonstrate an ability to design experiments to solve open-ended problems	4.2.1	Design and develop appropriate procedures/methodologies 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 collect and analyze data
		4.3.2	Critically 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
PO 5: 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, 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.

PO 6: 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,	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

	legal and public 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
PO 7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity			
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 ASME professional code of ethics
		7.2.2	Examine and apply moral & ethical principles to known case studies
PO 8: Individual and Collaborative Team work: 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
		8.2.3	Listen to other members
		8.2.4	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 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.			
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
		9.1.3	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: 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.			
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
		10.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project
10.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	10.2.1	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: Recognize the need for, and have the preparation and ability for i)independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking 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.
PSO 1: Demonstrate the ability to develop, deploy, and analyze Artificial Intelligence and Machine Learning solutions using appropriate techniques and tools to solve real-world problems.			
12.1	Apply Artificial Intelligence and Machine Learning concepts and techniques	12.1.1	Demonstrate knowledge of Artificial Intelligence and Machine Learning algorithms and methodologies.
		12.1.2	Apply suitable AI and ML techniques to solve computational and real-world problems.

12.2	Develop and deploy AI and ML solutions using appropriate tools and technologies	12.2.1	Design and implement AI and ML models using suitable programming tools and frameworks.
		12.2.2	Analyze and evaluate AI and ML solutions based on performance metrics and problem requirements.
		12.2.3	Deploy AI and ML solutions for practical applications considering scalability and efficiency.
PSO 2: Design and develop innovative Engineering solutions using emerging technologies and interdisciplinary approaches to meet industrial needs.			
13.1	Apply advanced AI technologies for interdisciplinary applications	13.1.1	Utilize advanced AI techniques in interdisciplinary domains to address domain-specific challenges.
		13.1.2	Integrate AI technologies with domain knowledge for innovative applications.
13.2	Interpret data and support intelligent decision-making using AI techniques	13.2.1	Analyze and interpret data using AI-based methods for extracting meaningful insights.
		13.2.2	Apply data-driven approaches to support intelligent decision-making processes.

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.

VELS
KNOWLEDGE IS POWER

ABBREVIATIONS

BSC	BASIC SCIENCE COURSE
SEC	SKILL ENHANCEMENT COURSE
MDC	MULTIDISCIPLINARY COURSE
MDE	MULTIDISCIPLIANRY ELECTIVE COURSE
PCC	PROGRAM CORE COURSE
PEC	PROFESSIONAL ELECTIVE COURSE
AEC	ABILITY ENHANCEMENT COURSE
VAC	VALUE ADDED COURSE
SI	SUMMER INTERNSHIP
PRD	PROJECT REPORT AND DISSERTATION

CURRICULUM STURUCTURE

B.Tech CSE- Artificial Intelligence & Machine Learning

Total number of Credits: 168

B.Tech., CSE- AI&ML Minimum Credits to be earned: 168										
SEMESTER 1										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
BSC		Mathematics 1 (Calculus and Linear Algebra)	3	0	2	4	4	40	60	100
BSC		Engineering Chemistry	3	0	0	3	3	40	60	100
MDC		Digital Principles and System Design	3	0	0	3	3	40	60	100
PCC		Structured and Object-Oriented Programming	3	0	0	3	3	40	60	100
AEC		Technical English	2	0	0	2	2	40	60	100
VAC		Universal Human Values-Understanding Harmony	3	0	0	3	3	40	60	100
BSC		Engineering Chemistry LAB	0	0	3	3	1.5	40	60	100
PCC		Structured and Object-Oriented Programming Lab	0	0	3	3	1.5	40	60	100
AEC		Technical English Lab	0	0	2	2	1	40	60	100
VAC		Student Induction Program			-	0	0	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 2										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
BSC		MATHEMATICS - 2 (Probability and Statistics)	3	0	2	4	4	40	60	100
BSC		Engineering Physics	3	0	0	3	3	40	60	100
BSC		Fundamentals of Electrical and Electronics Science	3	0	0	3	3	40	60	100
PCC		Modern computer architecture	3	0	0	3	3	40	60	100
PCC		Python Programming	3	0	0	3	3	40	60	100
SEC		Design thinking	2	0	0	2	2	40	60	100
BSC		Engineering Physics Lab	0	0	3	3	1.5	40	60	100
BSC		Fundamentals of Electrical and Electronics Science Lab	0	0	3	3	1.5	40	60	100
PCC		Python Programming Lab	0	0	3	3	1.5	40	60	100
SEC		IDEA Lab	0	0	2	2	0	40	60	100
			17	0	13	28	22.5	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

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

SEMESTER 3										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
BSC		MATHEMATICS - 3 (Transforms and Boundary Value Problems)	3	1	0	4	4	40	60	100
PCC		Java Programming	3	0	2	3	4	40	60	100
PCC		Operating System	3	0	0	3	3	40	60	100
PCC		Data Structure	3	0	0	3	3	40	60	100
PCC		Python for Machine Learning	3	0	2	3	4	40	60	100
SEC		Aptitude and coding skills I	2	0	0	2	2	40	60	100
PCC		Operating System Lab	0	0	3	3	1.5	40	60	100
PCC		Data Structure Lab	0	0	3	3	1.5	40	60	100
VAC		Constitution of India	2	0	0	2	0	40	60	100
			19	1	10	26	23	-	-	-

CIA - Continuous Internal Assessment SEE- Semester End Examination

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

SEMESTER 4										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
BSC		Mathematics 4 (Discrete Mathematics and Graph Theory)	3	1	0	4	4	40	60	100
PCC		Database Systems	3	0	0	3	3	40	60	100
PCC		Computer Networks	3	0	0	3	3	40	60	100
PCC		Data Visualization	3	0	0	3	3	40	60	100
PCC		Web Programming	3	0	2	4	4	40	60	100
SEC		Aptitude and coding skills 2	2	0	0	2	2	40	60	100
PCC		Database Systems Lab	0	0	3	3	1.5	40	60	100
PCC		Computer Networks Lab	0	0	3	3	1.5	40	60	100
SEC		CoCurricular and Extra curricular Activities -I	1	0	0	2	1	40	60	100
VAC		Basic life skills	2	0	0	2	0	40	60	100
VAC		Gender, Institution, and Society	1	0	0	1	0	40	60	100
			21	1	8	30	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	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
BSC		Environmental Science Engineering and SDGs	2	0	0	2	2	40	60	100
PCC		Artificial Intelligence	3	0	0	3	3	40	60	100
PCC		Machine Learning	3	0	0	3	3	40	60	100
PEC		Professional Elective Course - I	3	0	0	3	3	40	60	100
PEC		Professional Elective Course - II	3	0	0	3	3	40	60	100
MDE		Open Elective Course I	3	0	0	3	3	40	60	100
SEC		Aptitude and Advance coding skills I	2	0	0	2	2	40	60	100
PCC		Machine Learning Lab	0	0	3	3	1.5	40	60	100
PCC		Artificial Intelligence Lab	0	0	3	3	1.5	40	60	100
PRD		Mini Project	0	0	2	1	1	40	60	**100**
			19	**0**	**8**	**26**	**23**	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

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

SEMESTER 6										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
AEC		Innovation and Entrepreneurship	3	0	0	2	1	40	60	100
PCC		Deep Learning	3	1	0	4	4	40	60	100
PCC		Natural Language Processing	3	0	0	3	3	40	60	100
PEC		Professional Elective Course - III	3	0	0	3	3	40	60	100
PEC		Professional Elective Course - IV	3	0	0	3	3	40	60	100
MDE		Open Elective Course II	3	0	0	3	3	40	60	100
SEC		Aptitude and Advance Coding skills II	3	0	0	2	2	40	60	100
PCC		Deep Learning Lab	0	0	3	3	1.5	40	60	100
PCC		Natural Language Processing Lab	0	0	3	3	1.5	40	60	100
SI		Internship	0	0	0	1	1	40	60	100
			21	1	6	27	23	-	-	-

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

SEMESTER 7										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
PCC		Reinforcement Learning	3	0	0	3	3	40	60	100
PCC		Full Stack Development	3	0	2	4	4	40	60	100
PEC		Professional Elective Course - V	3	0	0	3	3	40	60	100
PEC		Professional Elective Course - VI	3	0	0	3	3	40	60	100
PCC		Reinforcement Lab	0	0	3	3	1.5	40	60	100
PRD		Project Phase I	0	0	6	6	3	40	60	100
SEC		CoCurricular and Extra curricular Activities -II	1	0	0	0	1	40	60	100
			13	0	11	22	18.5	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

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

SEMESTER 8										
			Hours/Week					Maximum Marks		
Category	Subject Code	Course	L	T	P	SL	C	CIA	SEE	Total
MDE		Open Elective Course III	3	0	0	3	3	40	60	100
MDE		Open Elective Course IV	3	0	0	3	3	40	60	100
PRD		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

LIST OF ALL BASIC SCIENCE COURSES

Category	Subject Code	Course	L	T	P	SL	C
BSC-01		Mathematics 1 (Calculus and Linear Algebra)	3	0	2	4	4
BSC-02		Engineering Chemistry	3	0	0	3	3
BSC-03		Engineering Chemistry Lab	0	0	3	3	1.5
BSC-04		Mathematics 2 (Probability and Statistics)	3	0	2	4	4
BSC-05		Engineering Physics	3	0	0	3	3
BSC-06		Engineering Physics Lab	0	0	3	3	1.5
BSC-07		Fundamentals of Electrical and Electronics science	3	0	0	3	3
BSC-08		Fundamentals of Electrical and Electronics science Lab	0	0	3	3	1.5
BSC-09		Mathematics 3 (Transforms and Boundary Values)	3	1	0	4	4
BSC-10		Mathematics 4(Discrete Mathematics and Graph Theory)	3	1	0	4	4
BSC-11		Environmental Science Engineering and SDGs	2	0	0	2	2

LIST OF ALL ABILITY ENHANCEMENT COURSES

Category	Subject Code	Course	L	T	P	SL	C
HSC-01		Technical English	2	0	0	2	2
HSC-02		Technical English Lab	0	0	2	2	1
HSC-03		Innovation and Entrepreneurship	3	0	0	1	1

LIST OF ALL MULTIDISCIPLINARY COURSES

Category	Subject Code	Course	L	T	P	SL	C
MDC-01		Digital Principles and System Design	3	0	0	3	3

LIST OF ALL PROGRAM CORE COURSES

Category	Subject Code	Course	L	T	P	SL	C
PCC-1		Structured and Object-Oriented Programming	3	0	0	3	3
PCC-2		Structured and Object-Oriented Programming Lab	0	0	3	3	1.5
PCC-3		Java Programming	3	0	2	4	4
PCC-4		Operating System	3	0	0	3	3
PCC-5		Data Structure	3	0	0	3	3
PCC-6		Python for Machine Learning	3	0	2	4	4
PCC-7		Operating System Lab	0	0	3	3	1.5
PCC-8		Data Structure Lab	0	0	3	3	1.5
PCC-9		Database Systems	3	0	0	3	3
PCC-10		Computer Networks	3	0	0	3	3
PCC-11		Data Visualization	3	0	0	3	3
PCC-12		Web Programming	3	0	2	4	4
PCC-13		Database Systems Lab	0	0	3	3	1.5
PCC-14		Computer Networks Lab	0	0	3	3	1.5
PCC-15		Artificial Intelligence	3	0	0	3	3
PCC-16		Machine Learning	3	0	0	3	3
PCC-17		Machine Learning Lab	0	0	3	3	1.5

PCC-18		Artificial Intelligence Lab	0	0	3	3	1.5
PCC-19		Deep Learning	3	1	0	4	4
PCC-20		Natural Language Processing	3	0	0	3	3
PCC-21		Deep Learning Lab	0	0	3	3	1.5
PCC-22		Natural Language Processing Lab	0	0	3	3	1.5
PCC-23		Reinforcement Learning	3	0	0	3	3
PCC-24		Full Stack Development	3	0	2	4	4
PCC-25		Reinforcement Learning Lab	0	0	3	3	1.5

LIST OF ALL PROFESSIONAL ELECTIVE COURSES

Category	Subject Code	Course	L	T	P	SL	C
PEC-01		Machine Learning for Data Science	3	0	0	3	3
PEC-02		Predictive Analytics	3	0	0	3	3
PEC-03		Soft Computing	3	0	0	3	3
PEC-04		Graph Machine Learning	3	0	0	3	3
PEC-05		Artificial Neural Networks	3	0	0	3	3
PEC-06		Quantum Computing	3	0	0	3	3
PEC-07		Social Network Analytics	3	0	0	3	3
PEC-08		High Performance Computing	3	0	0	3	3
PEC-09		Next Generation Computing	3	0	0	3	3
PEC-10		Generative AI	3	0	0	3	3
PEC-11		Large Language Models	3	0	0	3	3
PEC-12		Vibe Coding	3	0	0	3	3
PEC-13		Agentic AI	3	0	0	3	3
PEC-14		Blockchain Technologies	3	0	0	3	3
PEC-15		DevOps Principles and Practices	3	0	0	3	3

PEC-16		Augmented Reality/ Virtual Reality	3	0	0	3	3
PEC-17		Edge and Fog Computing	3	0	0	3	3
PEC-18		Java Springboot	3	0	0	3	3
PEC-19		MLOps	3	0	0	3	3
PEC-20		UI and UX Design	3	0	0	3	3
PEC-21		Cloud Computing	3	0	0	3	3
PEC-22		Compiler Design	3	0	0	3	3
PEC-23		IoT in Healthcare	3	0	0	3	3
PEC-24		Software Defined Networks	3	0	0	3	3
PEC-25		Generative AI and Prompt Engineering	3	0	0	3	3
PEC-26		IoT in 5G Networks	3	0	0	3	3
PEC-27		Distributed Computing System	3	0	0	3	3
PEC-28		Software Project Management	3	0	0	3	3
PEC-29		Software Engineering	3	0	0	3	3
PEC-30		Object Oriented Analysis and Design	3	0	0	3	3
PEC-31		Human Computer Interaction	3	0	0	3	3
PEC-32		Ethical Hacking	3	0	0	3	3
PEC-33		Open source	3	0	0	3	3
PEC-34		Software Testing	3	0	0	3	3
PEC-35		Game Programming	3	0	0	3	3

LIST OF MULTIDISCIPLIANRY ELECTIVE COURSES

Category	Subject Code	Course	L	T	P	SL	C
MEC-01		Electric Vehicles – Fundamentals	3	0	0	3	3
MEC-02		Energy Conservation and Management	3	0	0	3	3

MEC-03		Brain Computer Interface	3	0	0	3	3
MEC-04		Introduction to Wireless Technology	3	0	0	3	3
MEC-05		Disaster Management	3	0	0	3	3
MEC-06		Indian Knowledge System	3	0	0	3	3
MEC-07		Fundamentals of Wireless and Mobile Communication	3	0	0	3	3
MEC-08		Introduction to MATLAB	3	0	0	3	3
MEC-09		Foreign Language-German	3	0	0	3	3
MEC-10		Foreign Language-French	3	0	0	3	3
MEC-11		Foreign Language -Japanese	3	0	0	3	3
MEC-12		Principles of Management	3	0	0	3	3
MEC-13		Operations Research	3	0	0	3	3
MEC-14		Quality Control and Reliability Engineering	3	0	0	3	3
MEC-15		Total Quality Management	3	0	0	3	3
MEC-16		Supply Chain Management	3	0	0	3	3
MEC-17		Industry 4.0	3	0	0	3	3
MEC-18		Engineering Economics and cost analysis	3	0	0	3	3
MEC-19		Intellectual Property Rights	3	0	0	3	3
MEC-20		Professional Ethics in Engineering	3	0	0	3	3

LIST OF MULTIDISCIPLIANRY COURSE -NPTEL

MEC-21		AI Ethics	3	0	0	3	3
MEC-22		Digital Marketing in the AI Era	3	0	0	3	3
MEC-22		Design and Analysis of Algorithms	3	0	0	3	3

MEC-23		Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	3
MEC-24		Data Science for Engineers	3	0	0	3	3
MEC-25		Introduction to Information Retrieval	3	0	0	3	3
MEC-26		Data Mining for Decision Making	3	0	0	3	3
MEC-27		Python for Data Science	3	0	0	3	3
MEC-28		Introduction to Information Retrieval	3	0	0	3	3
MEC-29		The Joy of Computing using Python	3	0	0	3	3
MEC-30		Data Analytics with Python	3	0	0	3	3
MEC-31		Software Project Management	3	0	0	3	3
MEC-32		Software Engineering	3	0	0	3	3
MEC-33		Software Testing	3	0	0	3	3
MEC-34		Privacy and Security in Online Social Media	3	0	0	3	3

LIST OF ALL SKILL ENHANCEMENT COURSES

Category	Subject Code	Course	L	T	P	SL	C
SEC 1		Design thinking	2	0	0	2	2
SEC 2		IDEA Lab	0	0	2	2	0
SEC 3		Aptitude & coding skills I	2	0	0	2	2
SEC 4		Aptitude & coding skills 2	2	0	0	2	2
SEC 5		Student Induction Programme	0	0	0	0	0
SEC 6		CoCurricular and Extra curricular Activities-I	1	0	0	0	1
SEC 7		Aptitude and Advance coding skills I	2	0	0	2	2
SEC 8		Aptitude and Advance coding skills II	3	0	0	2	2

SEC 9		CoCurricular and Extra curricular Activities-II	1	0	0	0	1

LIST OF ALL SUMMER INTERNSHIPS

Category	Subject Code	Course	L	T	P	SL	C
SEC 1		Internship	0	0	0	1	1

LIST OF ALL VALUE ADDED COURSES

Category	Subject Code	Course	L	T	P	SL	C
VAC-1		Universal Human Values-Understanding Harmony	3	0	0	3	3
VAC-2		Student Induction Program	0	0	2	0	0
VAC-3		Constitution of India	2	0	0	0	0
VAC-4		Basic Life Skills	2	0	0	2	0
VAC-5		Gender, Institution and Society	1	0	0	1	0

PROJECT REPORT AND DISSERTATION

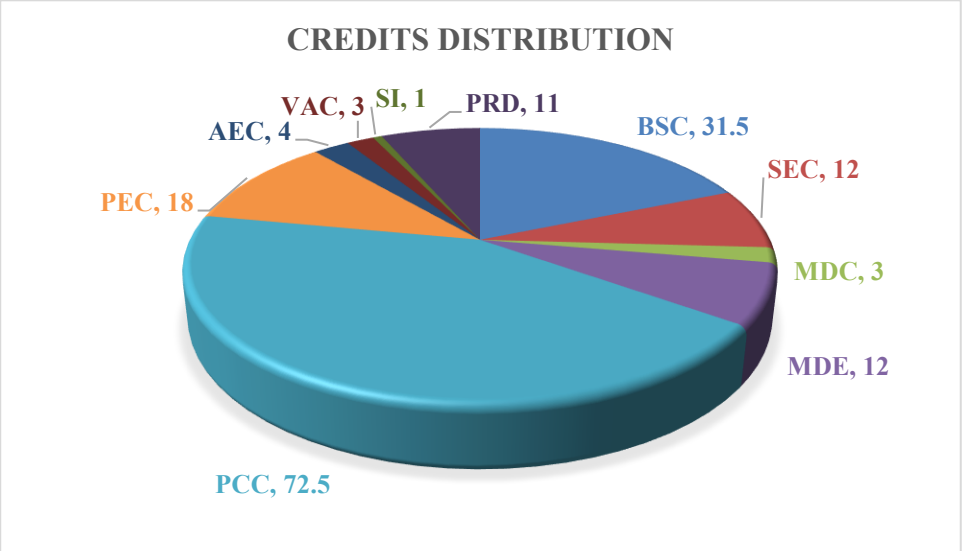
Category	Subject Code	Course	L	T	P	SL	C
PRD 1		Mini Project	0	0	2	1	1
PRD 2		Project Phase I	0	0	6	6	3
PRD 3		Project Phase II	0	0	14	2	7

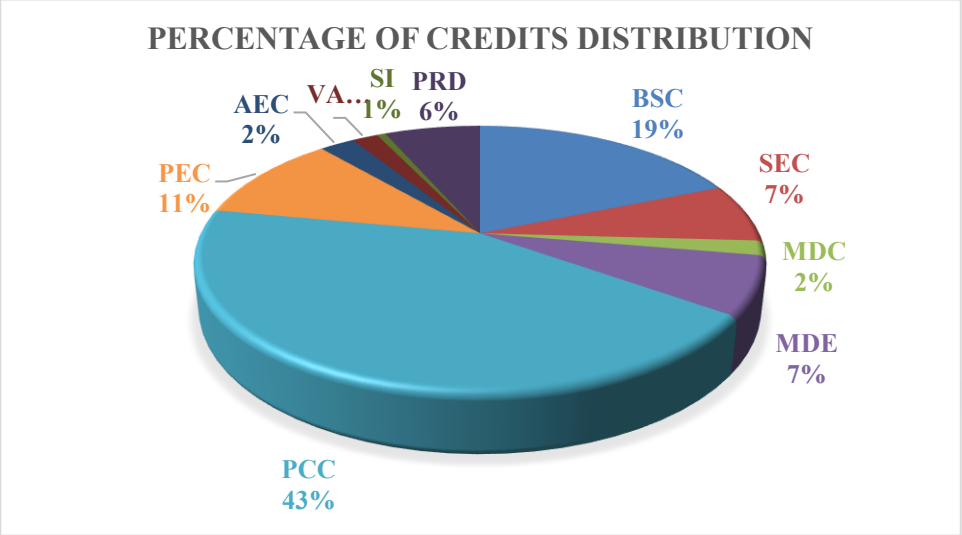
CREDIT DISTRIBUTION

B.Tech, Computer Science and Engineering Specialization with AI & ML

Minimum credits to be earned: 168

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	VII Sem	VIII Sem	4 Yrs Total Credits
BSC	8.5	13	4	4	2	0	0	0	31.5
SEC	0	2	2	3	2	2	1	0	12
MDC	3	0	0	0	0	0	0	0	3
MDE	0	0	0	0	3	3	0	6	12
PCC	4.5	7.5	17	16	9	10	8.5	0	72.5
PEC	0	0	0	0	6	6	6	0	18
AEC	3	0	0	0	0	1	0	0	4
VAC	3	0	0	0	0	0	0	0	3
SI	0	0	0	0	0	1	0	0	1
PRD	0	0	0	0	1	0	3	7	11
Total credits	22	22.5	23	23	23	23	18.5	13	168


CREDITS DISTRIBUTION
VAC, 3
SI, 1
PRD, 11
AEC, 4
BSC, 31.5
SEC, 12
PEC, 18
MDC, 3
MDE, 12
PCC, 72.5


PERCENTAGE OF CREDITS DISTRIBUTION
SI
PRD
VA...
AEC
1%
6%
2%
BSC
19%
SEC
7%
PEC
11%
MDC
2%
MDE
7%
PCC
43%

SEMESTER I

BSC	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).

UNIT-V	MATRICES	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 Hours: 60 Hours
Self-Learning:60 Hours

TEXT BOOKS:

1. Joel R. Hass, Christopher E. Heil, Maurice D. Weir, Przemysław Bogacki, Thomas' Calculus, 15thEdition, Pearson,2022.
2. RamanaB.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.

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

NPTEL COURSE

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.

COURSE OUTCOMES:

At the end of the course, the students 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	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	3	3	-	2	3	-	-	-	-	-	-	-	-
CO4	2	3	-	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	-	3	-	-	-	-	-	-	-	-
Avg	2.6	2.6	-	2	3	-	-	-	-	-	-	-	

BSC	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: H2-O2fuel 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 Hours: 45 Hours

Self-Learning:45 Hours

TEXT BOOKS:

1. Engineering Chemistry, by Prasanta Rath, 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 COURSES:

1. Concepts of Chemistry in Engineering https://nptel.ac.in/courses/104101130

COURSE OUTCOMES:

At the end of the course, the students 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	K3

	techniques to determine molecular structure, bonding, and material characteristics.	
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

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	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**	-	-	-	-	-	-

		L	T	P	SL	C
BSC	**ENGINEERING CHEMISTRY LAB**	**0**	**0**	**3**	**3**	**1.5**

PRE-REQUISITE	**NIL**	**CO-REQUISITE**	**NIL**

COURSE OBJECTIVES

The students will learn to:

- 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 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 Hours: 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. SundaramandK.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 organicAnalysis", Longmann, 12th edition, 2011
2. J.N.GurtuandR.Kapoor "Advanced experimental Chemistry", S.Chand and Co. 6th edition, 2010.

WEBLINKS

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

At the end of this course, the students 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	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	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	-	-	-	-	-	-

MDC	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	SL	C
		3	0	0	3	3

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES

- To understand the fundamental principles of Boolean algebra and techniques for simplifying logical expressions.
- To analyze and design combinational and sequential digital circuits using systematic design procedures.

- To acquire knowledge of memory devices and programmable logic devices for digital system implementation.

UNIT I	**LOGIC GATES, BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES**	**9 Hours**

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De-Morgan's Theorem, Minimum of Boolean Expressions, Minterm, Maxterm, Sum of Products (SOP) & Product of Sums (POS) forms, Canonical forms, Karnaugh maps, Quine Mc Cluskey method of minimization

UNIT II	**COMBINATIONAL LOGIC DESIGN**	**9 Hours**

Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Binary codes, Code Converters, Comparator, Multiplexer, Demultiplexer, Encoder, Decoder.

UNIT III	**SEQUENTIAL LOGIC DESIGN**	**9 Hours**

Flip Flop design: S-R, JK and Master-Slave JK, D and T FF, Edge triggered FF, Design of Asynchronous (Ripple) counters, Design of Synchronous counters, Modulo N Counter, Ring counter, Sequence Generators, Shift registers, Universal Shift Register, Finite state machines, Algorithmic State Machines charts.

UNIT IV	**MEMORIES, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES**	**9 Hours**

Memories: ROM, PROM, EPROM, EEPROM, RAM, Static RAM cell, Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM CELL. Programmable logic devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Array (FPGA). Logic Families: TTL, ECL, CMOS.

UNIT V	**VHDL CONCEPTS IN DIGITAL DESIGN**	**9 Hours**

Design entry: Different modeling styles in VHDL, Data types and objects, Dataflow, Behavioural and Structural Modeling, VHDL constructs and codes for combinational and sequential circuits.

Total Hours: 45 hours

Self-Learning: 45hours

TEXT BOOKS:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 5th edition, 2022.
2. M. Morris Mano, M. Morris Mano, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6e", Pearson Education, 2018.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 4th Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2018.
4. Stephen D. Brown, "Fundamentals Of Digital Logic With Vhdl Design", Tata McGraw Hill,

2025

REFERENCE BOOKS:

1. Donald D. Givone, Digital Principles and Design, Tata McGraw–Hill Education, 2017.
2. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
3. Douglas Perry, "VHDL", Tata McGraw Hill, 5th edition, 2012.
4. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

WEBLINKS:

1. www.tutorialspoint.com/digital_electronics/index.asp
2. www.coertvonk.com/hw/logic/synchronous-sequential-logic-30712

NPTEL:

1. **https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ec01**

COURSE OUTCOMEs:

At the end of the course, the students will be able to

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Apply laws of Boolean algebra and reduction techniques for digital circuit design	**K3**
CO2	Develop digital system using combinational and sequential design techniques	**K3**
CO3	Analyze digital circuit using Programmable Logic devices	**K4**
CO4	Choose appropriate digital circuits to realize digital system applications.	**K3**
CO5	Realize digital circuits using VHDL programming	**K4**

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	-		
CO2	3	3	3	3	-	-	-	-	-	-	-		
CO3	3	3	3	2	-	-	-	-	-	-	-		
CO4	-	-	2	2	-	-	-	-	-	-	-		
CO5	-	3	2	2	-	-	-	-	-	-	-		
AVG	**3**	**3**	**2.5**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		

PCC	STRUCTURED AND OBJECT ORIENTED PROGRAMMING	L	T	P	SL	C
		3	0	0	3	3

PRE-REQUISITE	NIL	CO-REQUISITE	STRUCTURED AND OBJECT ORIENTED PROGRAMMING LAB

COURSE OBJECTIVES:

- To impart fundamental knowledge of structured programming concepts and problem-solving techniques using the C programming language.
- To develop programming proficiency in arrays, functions, pointers, structures, and file handling for designing efficient computational solutions.
- To build competency in object-oriented programming concepts using C++ for developing modular, reusable, and scalable applications.

UNIT I	FUNDAMENTALS OF C PROGRAMMING	9 Hours

Introduction to programming paradigms – Overview and applications of C – Structure of a C program – Algorithm and flowchart basics – Data types, variables, constants, and keywords – Operators and expressions – Operator precedence and associativity – Input/Output statements – Conditional statements (if, if-else, nested if) – Switch statement – Looping statements (for, while, do-while) – Preprocessor directives – Compilation and execution process.

UNIT II	ARRAYS, STRINGS, AND FUNCTIONS IN C	9 Hours

Arrays: Declaration, initialization, one-dimensional and two-dimensional arrays – String handling: basic operations (length, copy, concatenate, compare) – Introduction to functions: function prototype, definition, function call – Parameter passing (pass by value) – Recursion (basic concepts and examples) – Simple algorithms: linear search, selection sort.

UNIT III	POINTERS AND USER-DEFINED DATA TYPES IN C	9 Hours

Pointers: Declaration, initialization, pointer operators, pointer arithmetic – Arrays and pointers – Passing parameters by reference – Structures: declaration, initialization, nested structures, array of structures – Union and typedef – Storage classes and scope – FILE PROCESSING: Files – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

UNIT IV	INTRODUCTION TO C++ AND OBJECT-ORIENTED PROGRAMMING	9 Hours

Transition from C to C++ – Basic structure of C++ program – Input/Output using cin and cout – Introduction to Object-Oriented Programming concepts – Classes and objects – Access specifiers

(public, private, protected) – Constructors and destructors (default and parameterized) – Basic examples.		
UNIT V	**OBJECT-ORIENTED FEATURES AND FILE HANDLING IN C++**	**9 Hours**
Inheritance: single and multilevel inheritance – Function overloading– Introduction to polymorphism – Virtual functions and abstract classes – Exception handling (try, catch, throw) – File handling in C++: file streams, reading and writing text files – Basic introduction to templates.		

Total Hours: 45 hours

Self-Learning: 45 hours

TEXT BOOKS:

1: Balagurusamy, E., *Programming in ANSI C*, 9th Edition, McGraw Hill Education (India) Pvt. Ltd., **2024**.
2: Kanetkar, Y.P., *Let Us C*, 20th Edition, BPB Publications, **2022**.
3: Lippman, S.B., Lajoie, J., Moo, B.E., *C++ Primer*, 6th Edition, Addison-Wesley / Pearson, **2024**.

REFERENCE BOOKS:

1. King, K.N., *C Programming: A Modern Approach*, 2nd Edition, W.W. Norton & Company, 2020
2. Stroustrup, B., *A Tour of C++*, 3rd Edition, **2022**

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-programminglanguage/
3. GNU C Library Documentation - https://www.gnu.org/software/libc/manual/
4. https://en.cppreference.com/w/cpp

NPTEL LINKS:

1. " Problem Solving Through Programming In C" by Prof. Anupam Basu, IIT Kharagpur https://nptel.ac.in/courses/106105171
2. Programming in Modern C++ By Prof. Partha Pratim Das IIT Kharagpur

COURSE OUTCOMES:

At the end of the course, the students will be able to

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Apply fundamental programming concepts, control structures, and operators to develop C programs for computational problem solving.	K3

CO2	Implement arrays, strings, functions, pointers, and user-defined data types in C for structured programming applications.	K4
CO3	Develop programs using file handling techniques and command line arguments for data processing applications.	K4
CO4	Design object-oriented programs using classes, objects, constructors, inheritance, and polymorphism in C++.	K5
CO5	Develop modular C++ applications using exception handling, virtual functions, templates, and file handling concepts.	K5

COURSE ARTICULATION MATRIX

COs - POs & PSOs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PS O1	PSO 2
CO1	3	2	–	–	3	–	–	–	–	–	–	–	–
CO2	3	–	2	–	2	–	–	–	–	–	–	–	–
CO3	3	3	3	2	-	–	–	–	–	–	–	–	–
CO4	3	3	–	–	3	–	–	–	–	–	–	–	–
CO5	3	–	3	3		–	–	–	–	–	–	–	–
AVG	**3.0**	**2.6**	**2.6**	**2.5**	**2.6**	–	–	–	–	–	–	–	–

PCC	STRUCTURED AND OBJECT ORIENTED PROGRAMMING LAB	L	T	P	SL	C
		0	0	3	3	1.5

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES

- To develop fundamental programming skills using structured programming concepts and problem-solving techniques.
- To apply control structures, arrays, functions, pointers, and user-defined data types for solving computational problems effectively.
- To implement modular programming and file handling concepts for developing efficient software applications.

List of Experiments

Fundamentals of Programming using C

1. Introduction to programming environment and execution of simple C programs.
2. Solving basic problems using arithmetic expressions and operators.
3. Implementation of decision-making using conditional statements.
4. Development of programs using looping constructs.
5. Operations on one-dimensional arrays.
6. Solving problems using two-dimensional arrays (matrices).

Functions, Strings, Pointers, and File Processing in C

7. Design and implementation of user-defined functions.
8. Implementation of recursive techniques.
9. Basic string handling operations.
10. Applications of pointers and structures.
11. Implementation of file handling operations including sequential and random access.
12. Development of simple searching and sorting algorithms.

Fundamentals of Object-Oriented Programming using C++

13. Introduction to C++ programming environment and execution of simple programs.
14. Solving basic problems using arithmetic expressions in C++.
15. Implementation of classes and objects.
16. Demonstration of constructors, destructors, and function overloading.
17. Development of programs using inheritance concepts.

Advanced Object-Oriented Features and File Handling in C++

18. Implementation of polymorphism using virtual functions.
19. Exception handling using try, catch, and throw blocks.
20. File handling operations and basic template applications in C++.

Total Hours: 45 Hours
Self-Learning:45 Hours

TEXT BOOKS:

1.Programming in ANSI C – *E. Balagurusamy*, 8th Edition, McGraw Hill Education (India) Pvt. Ltd, 2022

2.Object Oriented Programming with C++ – *E. Balagurusamy*, 8th Edition, McGraw Hill.2022

REFERENCE BOOKS:

1. Stroustrup, B., *A Tour of C++*, **Addison-Wesley. ISBN-10: 0-13-681648-7.**3rd Edition, **2022**

2. C: The Complete Reference – *Herbert Schildt*, 4th Edition, McGraw Hill **,2000**

3. C++ Primer – *Stanley B. Lippman, Josée Lajoie, Barbara E. Moo*, 5th Edition, Pearson Education, 2012

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/
4. https://en.cppreference.com/w/cpp

NPTEL Links :

1. 1." Problem Solving Through Programming In C" by Prof. Anupam Basu, IIT Kharagpur https://nptel.ac.in/courses/106105171
2. Programming in Modern C++ By Prof. Partha Pratim Das IIT Kharagpur https://nptel.ac.in/courses/106105234

COURSE OUTCOMES:

At the end of the course, the students will be able to

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Design structured C programs using operators, control statements, arrays, and functions for problem solving.	K4
CO2	Develop C programs using pointers, structures, recursion, and file handling techniques for efficient data processing.	K5
CO3	Evaluate searching, sorting, and string handling techniques using structured programming concepts.	K5
CO4	Design object-oriented programs using classes, objects, constructors, inheritance, and polymorphism in C++.	K5
CO5	Develop modular C++ applications using exception handling and file processing concepts.	K5

COURSE ARTICULATION MATRIX

COs - POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2

CO1	3	3	2	–	3	–	–	–	–	–	–	-	–
CO2	3	3	3	–	–	–	–	–	–	–	–	–	–
CO3	3	2	-	2	2	–	–	–	–	–	–	–	–
CO4	3	2	3	-	-	–	–	–	–	–	–	–	–
CO5	3	3	-	3	3	–	–	–	–	–	–	–	–
AVG	**3**	**2.6**	**2.6**	2.5	**2.6**				–	–	–	–	–

AEC	**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**

To enable students to identify and correct grammatical and syntactic errors, in English Language use such as Pronouns - Relative pronouns, Demonstrative pronouns, Articles, Prepositions, Tenses, Subject-verb Agreement, Misplaced Modifiers, Redundancies, Infinitives & Gerund.

UNIT IV	NATURE AND STYLE OF 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 to general information-specific details- conversation: Introduction to classmates, Telephone conversation, Debates and panel discussions, Self-Introduction, Introducing a friend; Conversation, Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Group discussions, and Expressing opinions, Simulations & Role play. Reading editorials; and Opinion Blogs.		

Total Hours: 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_Brochu re.pdf

NPTEL LINKS

https://onlinecourses.nptel.ac.in/noc26_hs74/preview

COURSE OUTCOMES:

At the end of the course, the students 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	PO 10	PO 11	PSO 1	PSO 2
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	-	-

AEC	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 **40**

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 Hours: 30 hours

Self-Learning:30 hours

TEXT BOOKS:

1. M.AshrafRizvi, “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:

At the end of the course, the students 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	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	2	-	-	--
CO3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	3	-	2	-	-	-
AVG	-	-	-	-	-	-	-	3	2.3	2	2	-	-

VAC	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 FOR VALUE EDUCATION	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**	**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 Hours: 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
4. 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:

At the end of this course the students will be able to,

COURSE OUTCOME	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

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
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	-	-	-	-	-

SEMESTER II

BSC	MATHEMATICS-II(Probability and Statistics)	L	T	P	SL	C
		3	0	2	4	4

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES

- To provide fundamental knowledge of probability theory, random variables, probability distributions and statistical techniques for engineering applications.
- To develop the ability to apply correlation, regression and hypothesis testing methods for analysing and interpreting statistical data.
- To equip students with analytical skills in sampling theory and design of experiments for solving real-world problems involving variability and decision making

UNIT I	BASICPROBABILITY	12 Hours

Introduction to Probability- Conditional probability – Bayes Theorem- Random Variables– Discrete random variables-Continuous Random Variables – Moments – Mathematical Expectations and its Properties – Covariance – Moment generating Functions – Probability mass function–Probability density function.

UNITII	STANDARD DISTRIBUTIONS	12 Hours

Introduction to theoretical distribution – Discrete Distributions Bernoulli, Binomial, Poisson, Geometric, Negative Binomial Distributions–Continuous Distribution–Uniform, Normal, Exponential and Gamma distribution–Weibull Distribution–Properties.

UNIT III	CORRELATION AND REGRESSION ANALYSIS	12 Hours

Correlation: Types of Correlation–Methods of studying correlation– Scatter diagram method, Karl Pearson's Coefficient of correlation, Spearman's Rank Correlation Coefficient.
Regression: Regression Lines and Regression equations –- simple problems

UNIT IV	SAMPLING	12 Hours

Testing of Hypothesis – Types of Errors – Critical Region ,Procedure for testing of hypothesis-Large Sample tests – Z test for single Proportion –Difference of Proportion – Mean and Difference of Means – Small sample tests-Student's t-test – F-test— Chi-square test for goodness of fit and independence of attributes.

UNIT V	ANOVA AND DESIGN OF EXPERIMENTS	12 Hours

Introduction to ANOVA - Types of ANOVA – Components of an ANOVA Table – One –way Classification – Completely Randomised Design(CRD) – Advantages of CRD – Applications of CRD – Two-way Classifications – Randomized Block Design (RBD) and Latin Square Design (LSD) – Advantages and Applications of RBD and LSD

Total Hours: 60 hours
Self-Learning:60 hours

TEXT BOOKS

1. Amit Gupta , Manish Sharma, The Practice of Business Statistics, Khanna Book Publishing Company, 2026 (AICTE Recommended Textbook)
2. B.Krishna Gandhi, Dr.T.K.V.Iyyengar, Dr.M.V.S.S.N. Prasad, S.Ranganatham, S Chand Publishing , 2020
3. Das N. G., Statistical Methods, Combined Edition (Vol.I&II), Tata McGraw Hill,27th Edition 2022.
4. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2024.
2. Mine Cetinkaya –Rundel and Johanna Hardin, Introduction to Modern Statistics, OpenIntro Inc.,2021
3. Montgomery Douglas and Runger, George C., Applied Statistics and Probability for Engineers, Wiley, 2016. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024

NPTEL COURSE:

Course Name: Probability and Statistics

Handled by: Prof. Somesh Kumar | IIT Kharagpur

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview

List of Experiments

1. Computation of expected value for the probability mass function and probability density function.
2. Generate Binomial random variables and analyse their properties
3. Generate Negative Binomial distribution samples.
4. Testing of Hypothesis and Confidence intervals using – Z-test and t – test
5. Verify positive correlation using sample students marks .
6. Calculate rank correlation for ten students marks obtained in two subjects.
7. Perform one – way ANOVA using suitable example.
8. Analyse crop yield data using one way ANOVA.

COURSE OUTCOMES

At the end of this course the students will be able to,

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Analyze discrete random variables and probability distributions	**K4**
CO2	Analyze continuous random variables and probability distributions	**K4**

CO3	Identify appropriate statistical measures for central tendency and dispersion	**K3**
CO4	Construct correlation coefficients and regression models for practical problem solving.	**K3**
CO5	Analyze the applications and limitations of hypothesis testing in engineering problems.	**K4**

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-		
CO2	3	2	-	-	2	-	-	-	-	-	-		
CO3	3	2	-	-	3	-	-	-	-	-	-		
CO4	3	3	2	2	3	-	-	-	-	-	-		
CO5	3	3	-	2	3	-	-	-	-	-	-		
AVG	**3**	**2.4**	**2**	**2**	**2.6**								

BSC	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**SL**	**C**
		3	**0**	**0**	**3**	**3**

PRE-REQUISITE	**NIL**	**CO-REQUISITE**	**ENGINEERING PHYSICS LAB**

COURSE OBJECTIVES

- To learn the basics of electronic materials, semiconducting materials and their interaction with light, new engineered semiconductor devices.
- To apply these fundamental principles to solve practical problems related to materials used for engineering applications

UNIT I	**BAND THEORY OF SOLIDS**	**9 Hours**

Energy bands in solids: conductors - semiconductors and insulators - Band gaps in semiconductors - Direct and indirect band gaps semiconductors - Classical free electron theory - Drude and Lorentz classical free electron theory - electrical conductivity and thermal conductivity - Wiedemann-Franz Law -Lorentz number - Fermi distribution function - Effect of temperature on Fermi function - Density of energy states

UNIT II	**SEMICONDUCTORS**	**9 Hours**

Introduction - Properties of semiconductors - Classification of semiconductors - Types: Intrinsic and Extrinsic semiconductor - Carrier concentration of intrinsic and extrinsic (derivation) - Carrier concentration in n type and p type semiconductor - Variation of Fermi level with temperature and impurity concentration.

UNIT III	LIGHT-SEMICONDUCTOR INTERACTION	9 Hours
Optical transitions in bulk semiconductors: Stimulated absorption - spontaneous and stimulated emission – Excitons - Population Inversion - Einstein's A & B coefficient (derivation) – Principle and working of Photovoltaic effect and Solar cells – Applications.		
UNIT IV	**SEMICONDUCTOR DEVICES AND MEASUREMENTS**	**9 Hours**
Semiconductor diodes – Characteristics - construction and working – Types of semiconductor diodes – Light Emitting Diode (LED) – Measurements: Principle and working of UV-Vis spectrophotometer - Hall effect – Hall effect in n-type and p-type semiconductor (derivation) – Experimental determination of Hall coefficient – Applications.		
UNIT V	**ADVANCED ENGINEERED SEMICONDUCTOR MATERIALS**	**9 Hours**
Metallic glasses, preparation, properties and applications - Shape Memory Alloys – Characteristics, Properties of Ni-Ti alloy - Applications – Quantum nanostructures - Semiconductor Nanomaterials: - Properties -Synthesis (top-down and bottom-up approach) – Pulsed Laser deposition – Chemical vapour deposition – Applications		

Total hours: 45 Hours

Self-Learning:45 Hours

TEXT BOOKS:

1. Murugeshan R, Kiruthiga Sivaprasath, 'Modern Physics', S Chand Publisher, 2026.
2. Dr. Mani P, 'A textbook of Engineering Physics – II', Shri Dhanam Publisher, Chennai, 2016
3. Rajendran V, and Marikani A, 'Materials Science', Tata McGraw-Hill publications, New Delhi, 2011
4. Vijaya, M., and Rangarajan, G., 'Materials Science', Tata McGraw-Hill Publications, New Delhi, 2006.

REFERENCE BOOKS:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
2. Charles Kittel 'Introduction to Solid State Physics', John Wiley and Sons, 7th edition,
3. Singapore 2008.
4. Kasap S.O, "Principles of Electronic Materials", 3rd edition, McGraw-Hill Higher Education, 2006.
5. Pradeep T, "A textbook of Nanoscience and Nanotechnology, " McGraw-Hill Higher Education, 2012.
6. Palanisamy P.K, 'Materials Science', Scitech publications, Chennai, 2007.
7. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
8. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

NPTEL LINKS:

1. Fundamentals of Semiconductor devices, IISc Bangalore, Prof. Digbijoy N. Nath

2. Introduction to Semiconductor Devices, Prof. Naresh Kumar Emani, IIT Hyderabad

WEB LINKS:

1. https://nptel.ac.in/courses/115102026/2
2. https://nptel.ac.in/courses/115102026/15
3. http://textofvideo.nptel.ac.in/115102026/lec18.pdf
4. https://nptel.ac.in/courses/122103010/34
5. http://orbit.dtu.dk/files/4817236/petersen.pdf

COURSE OUTCOMES

At the end of this course, the students will be able to

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Identify the behaviour of free electrons in conducting materials.	K3
CO2	Analyse the type of semiconducting materials and their applications.	K4
CO3	Identify the applications of photovoltaic and solar cells.	K3
CO4	Demonstrate the construction and working of various semiconductor devices.	K2
CO5	Develop the design and fabrication of nanostructures.	K3

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	-	-	-	-	-	-	2	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	-	-
Avg	**2.50**	**2.60**	**2.75**	**2.50**	**-**	-	-	-	-	-	**2.66**	-	-

BSC	ENGINEERING PHYSICS 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 Mechanics of Solids and Properties of Matter.
- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables.

Any Eight Experiments

1. Determination of Rigidity Modulus – Torsional pendulum
2. Determination of wavelength and particle size using a laser
3. Ultrasonic Interferometer
4. Determination of the 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 Hours: 45 hours
Self - Learning: 45 hours

TEXT BOOKS:

1. C. C. Ouseph, U. J. Rao, V. Vijiayendran, Practical Physics,1st Edition, 2015.
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

At the end of this course, the students 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	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	-	-	3	3	3	3	-	-	-	-	-	-	-
CO2	-	-	-	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**	-	-

BSC	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).		

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*, 7th Edition, McGraw Hill Education, 2023.
3. Schaum's Outline Series, *Basic Electrical Engineering*, 3rd Edition, McGraw Hill, 2024.
4. J.B. Gupta, *Fundamentals of Electrical Engineering*, Kataria & Sons, 2023.
5. 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 LINK:

1. https://nptel.ac.in/courses/108105112

COURSE OUTCOMES

On completion of the course, the students 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	PSO 1	PSO 2
CO1	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	3	2	-	-	-	-	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	-
AV G	2.8	2.5	-	-	2.25	3	2	-	-	-	-	-	-

BSC	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:

- To understand and verify basic electrical laws and network principles, and measure electrical parameters using standard methods.
- To analyze the performance characteristics of electrical machines such as transformers and DC motors through experimental testing.
- To study the characteristics and applications of basic semiconductor devices and power electronic 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 Hours: 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:

On completion of the course the learner 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	PSO 1	PSO 2
CO1	3	3	-	3	2	-	-	-	-	-	-	-	-
CO2	3	3	-	3	2	-	-	-	-	-	-	-	-
CO3	3	2	-	3	2	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	3	3	-	-	-	-	-	-	-	-
AVG	2.8	2.5	-	3	2.25	-	-	-	-	-	-	-	-

PCC	MODERN COMPUTER ARCHITECTURE	L	T	P	SL	C
		3	0	0	3	3

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES

- To understand the fundamentals of computer organization, instruction execution, arithmetic circuits, pipelining, cache memory concepts, and multicore processor architectures.
- To analyze memory hierarchies, cache optimization techniques, Network-on-Chip (NoC) architectures, and performance enhancement mechanisms in modern computing systems.
- To understand and apply the principles of distributed computing, concurrency, synchronization, coordination algorithms, and high-performance computing techniques including parallel architectures, memory models, vectorization, and multithreading.
- To develop GPU-based parallel programs using the CUDA programming model and evaluate CPU‑GPU computing paradigms for high-performance computational applications.

UNIT I	BASICS	9 Hours
Designing combinational and sequential logic, computers registers and instructions, timing, and control, instructions cycle, memory reference instruction, I/O interruption, Adder and Subtractor circuits, Booth Multiplication Algorithm, Pipelining Review, control hazards and the motivation for caches, cache characteristics and basic superscalar architecture basics.		
UNIT II	**MULTI-CORE ARCHITECTURE**	**9 Hours**
Memory technologies, hierarchical memory systems, the locality principle and caching, direct-mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimizations, performance improvement techniques, DRAM - organization, access techniques, scheduling algorithms and signal systems. Tiled Chip Multicore Processors (TCMP), Network on Chips (NoC), NoC router - architecture, design, routing algorithms and flow control techniques, Advanced topics in NoC and storage - compression, prefetching, QoS.		
UNIT III	**DISTRIBUTED COMPUTING SYSTEMS AND CONCURRENCY**	**9 Hours**
Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs,Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Coordination and Agreement Algorithms, Global State and Distributed Transactions.		
UNIT IV	**HIGH PERFORMANCE COMPUTING (HPC)**	**9 Hours**
HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.		
UNIT V	**HIGH PERFORMANCE COMPUTING WITH CUDA**	**9 Hours**
CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange.		

Total Hours: 45 Hours

Self-Learning:45 Hours

ALTERNATIVE NPTEL/SWAYAM COURSE:

1. Computer Architecture Prof. Smruti Ranjan Sarangi Iit Delhi
2. Advanced Computer Architecture Prof.John Jose Iit Guwahati

TEXT BOOKS/SUGGESTED REFERENCES:

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach,

3. Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
4. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
5. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P.
6. Singh with Anoop Gupta, Morgan Kaufmann, 1998.
7. https://onlinecourses.nptel.ac.in/noc20_cs41/preview
8. https://www.coursera.org/learn/introduction-high-performance-computing#syllabus

COURSE OUTCOMES:

After completion of course, students would be able to:

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Explain the organization of computer systems, instruction cycles, arithmetic circuits, pipelining, and cache memory fundamentals.	K2
CO2	Analyze memory hierarchies, multicore architectures, cache optimization techniques, and Network-on-Chip (NoC) designs for improved system performance.	K4
CO3	Examine distributed computing models, synchronization mechanisms, concurrency issues, and coordination algorithms in distributed environments.	K4
CO4	Apply high-performance computing techniques including parallel processing, memory models, vectorization, and multithreading to solve computational problems	K3
CO5	Develop CUDA-based parallel programs utilizing GPU architectures, threads, blocks, and CPU–GPU communication mechanisms.	K3

COURSE ARTICULATION MATRIX

CO POs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO1 1	PSO 1	PSO2
CO1	3	3	0	2	-	-	-	-	-	-	-	2	-
CO2	0	3	2	2	-	-	-	-	-	-	-	-	-
CO3	0	2	3	0	-	-	-	-	-	-	-	-	-
CO4	0	0	3	2	-	-	-	-	-	-	-	2	-
CO5	3	3	0	2	-	-	-	-	-	-	-	-	-
Average	3.00	2.50	2.67	2.00	-	-	-	-	-	-	-	2	-

PCC	PYTHON PROGRAMMING	L	T	P	SL	C
		3	0	0	3	3

PRE-REQUISITE	NIL	CO-REQUISITE	PYTHON PROGRAMMING LAB

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	9 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	9 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	9 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	9 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	9 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 Hours: 45 Hours

Self-Learning:45 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 COURSE:

The Joy of Computing using Python By Prof. Sudarshan Iyengar IIT Ropar

https://nptel.ac.in/courses/106106182

COURSE OUTCOMES:

After completion of course, students would 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	PSO 1	PSO 2
CO1	3	3	-	-	3	–	–	–	–	–	–	–	–
CO2	3	2	-	3	2	–	–	–	–	–	–	–	–

CO3	3	3	2	-	3	–	–	–	–	–	–	–	–
CO4	3	2	3	-	3	–	–	–	–	–	–	–	–
CO5	3	3	-	2	3	–	–	–	–	–	–	–	–
AVG	**3**	**2.8**	**2.5**	**2.5**	**2.8**	–	–	–	–	–	–	–	–

PCC	PYTHON PROGRAMMING LAB	L	T	P	SL	C
		0	0	3	3	1.5

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES:

- To develop practical programming skills using Python syntax, operators, and control structures for problem solving.
- To implement Python data structures, functions, arrays, and exception handling techniques for developing efficient programs.
- To apply file handling, modules, packages, and Python libraries for data analysis and application development through hands-on exercises.

List of Experiments

Fundamentals of Python Programming

1. Introduction to Python programming environment and execution of simple programs.
2. Solving basic problems using arithmetic expressions and operators.
3. Implementation of decision-making statements using if, if-else, and nested if.
4. Development of programs using looping constructs.
5. Programs using lists and list operations.
6. Programs using tuples, sets, and dictionaries.
7. String manipulation and built-in string operations.

Functions, Arrays, and Exception Handling

8. Programs using list, set, and dictionary comprehensions.
9. Implementation of accumulation techniques for solving simple problems.
10. Development of programs using user-defined functions.
11. Programs demonstrating parameter passing and recursion.
12. Programs using lambda functions and built-in functions.
13. Operations on one-dimensional and two-dimensional arrays.
14. Exception handling using try, except, finally, and raise statements.

Data Analysis using Python Libraries

15. Programs using NumPy arrays, indexing, and array operations.
16. Data manipulation using Pandas Series and DataFrames.
17. Handling missing data and basic data analysis using Pandas.
18. Data visualization using Matplotlib line, bar, and scatter plots.

File Handling and Modular Programming

19. File handling operations including reading, writing, and appending text files.
20. Programs using modules, packages, and command line arguments.

Total Hours: 45 Hours
Self-Learning:45 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**

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3. https://www.sitepoint.com/python
4. https://realpython.com/

NPTEL LINKS:

The Joy of Computing using Python By Prof. Sudarshan Iyengar IIT Ropar

https://nptel.ac.in/courses/106106182

COURSE OUTCOMES:

After completion of course, students would be able to:

COURSE OUTCOMES	DESCRIPTION	KNOWLEDG LEVEL
CO1	Develop Python programs using syntax, operators, control structures, and data types for solving computational problems.	K4
CO2	Implement Python data structures such as lists, tuples, sets, dictionaries, and strings for data manipulation applications.	K4
CO3	Design modular Python programs using functions, arrays, recursion, lambda functions, and exception handling techniques.	K5
CO4	Apply NumPy, Pandas, and Matplotlib libraries for data analysis, processing, and visualization tasks.	K5
CO5	Develop Python applications using file handling, modules, and packages for efficient software and data processing applications.	K5

COURSE ARTICULATION MATRIX

COs - POs & PSOs	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	3	3	-	3	–	–	–	–	–	–	–	–
CO2	3	2	-	2	2	–	–	–	–	–	–	–	–
CO3	3	3	3	-	3	–	–	–	–	–	–	–	–
CO4	3	2	-	-	3	–	–	–	–	–	–	–	–
CO5	3	3	-	3	3	–	–	–	–	–	–	–	–
AVG	**3**	**2.8**	**3**	**2.5**	**2.8**				–	–	–	–	–

SEC	DESIGN THINKING	L	T	P	SL	C
		2	0	0	2	2

PRE-REQUISITE	NIL	CO-REQUISITE	NIL

COURSE OBJECTIVES:

- To understand the principles, concepts and importance of Design Thinking in engineering and innovation.
- To develop empathy and problem-identification skills to address real-world challenges effectively.
- To apply creative ideation and analytical techniques for generating innovative solutions.
- To gain knowledge in prototyping, testing and iterative product development methodologies.

UNIT 1	FUNDAMENTALS OF DESIGN THINKING - THE 'FEEL' STAGE	9 Hours

Design Thinking and its significance - Design The ThinkingTM - Personal Visualization, The Wheel of Life & Balancing Priorities - Concept of 'Design' - The 3 Laws of Design Thinking Objectives of this stage - Role of a Design Thinker in this stage - Tools used in this stage - Purpose of this stage - Persona - Journey Mapping - Stakeholder Mapping - Cartographic Perspective (L0) - Empathy Map - Case Study: Stakeholder understanding and identification of the problem area (Project Area)

UNIT II	THE 'DEFINE' STAGE	9 Hours

Empathy in Design Thinking, user observation techniques, interview methods and customer interaction, understanding user needs and pain points, stakeholder mapping, problem identification

and need analysis, problem framing techniques, "How Might We" statements, real-time case studies and user experience analysis.		
UNIT III	**THE 'DIVERGENCE' STAGE**	**9 Hours**
Purpose of this stage - Role of a Design Thinker - Key aspects of idea generation - Tools used in this stage - Purpose of this stage - Brainstorming - Metaphor - Random Association Technique - Mind Mapping - End-State Visualization - Case Study: Problem expansion (Contd)		
UNIT IV	**THE 'CONVERGENCE' STAGE**	**9 Hours**
Purpose of this stage – Role of a Design Thinker – Key aspects of solution selection – Tools used in this stage – Purpose of this stage – 10gm-100gm-1000gm QBL – Prototyping – Wire framing for digital products – Case Study: Prototyping and communication for effective outcomes		
UNIT V	**THE 'COMMUNICATION' STAGE**	**9 Hours**
Purpose of this stage – Role of a Design Thinker – Key aspects of communication – Tools used in this stage – Purpose of this stage – The 4Cs Framework – Naming – Packaging – Storyboarding – Presentation – Distribution - Case Study: Prototyping and communication for effective outcome (Contd) – Final Project Presentation		

Total Hours: 45 Hours
Self-Learning:45 Hours

Text Books:

1. Rakesh, Pawan Kumar, Apurbba Kumar Sharma, and Inderdeep Singh. Advances in Engineering Design. Singapore: Springer Singapore, 2021.
2. Cross, Nigel. Design thinking: Understanding how designers think and work. Bloomsbury Publishing, 2023.
3. Seitz, Tim. "Design Thinking." Handbook of Innovation: Perspectives from the Social Sciences. Cham: Springer Nature Switzerland, 2025. 1-12.

REFERENCE BOOKS:

1. Norman, Donald A. Design for a better world: Meaningful, sustainable, humanity centered. MIT Press, 2024.
2. Donald Norman, The Design of Everyday Things, United States, 1988.
3. Cleveland, Wade J. How is Design Thinking Applied in Practice?. Drexel University, 2023.
4. Allworth, Julia, et al. Design thinking in student affairs: A primer. Routledge, 2023.

Web Links:

1. https://www.youtube.com/watch?v=-9QTfY74G90&list=PLyqSpQzTE6M9hJRhUZCgYhSWlxKgiOXa1

2. https://www.youtube.com/watch?v=STK2l8Fz7Ek&list=PLyqSpQzTE6M9hJRhUZCgYhSWlxKgiOXa1&index=2
3. https://www.youtube.com/watch?v=oqMbfDaLEQQ&list=PLyqSpQzTE6M9hJRhUZCgYhSWlxKgiOXa1&index=3
4. https://www.youtube.com/watch?v=6-NRiom8K9Y&list=PLyqSpQzTE6M9hJRhUZCgYhS

NPTEL Courses:

1. Design Thinking - A Primer - By Prof. Ashwin Mahalingam, Prof. Bala Ramadurai https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg32

COURSE OUTCOMES

At the end of this course, the students will be able to

COURSE OUTCOMES	DESCRIPTION	KNOWLEDGE LEVEL
CO1	Explain the concepts, principles, and stages of Design Thinking and their role in problem-solving.	K2
CO2	Identify user needs and define problems using empathy-based and problem-analysis tools.	K3
CO3	Apply creative thinking techniques to generate innovative ideas and alternative solutions.	K3
CO4	Evaluate, select, and develop suitable solutions through prototyping and wireframing methods.	K4
CO5	Apply the Design Thinking process to real-world challenges and effectively communicate user-centered solutions.	K3

COURSE ARTICULATION MATRIX

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	–	–	–	–	–	–	–	–	–	–	–	–
CO2	2	3	–	–	–	–	–	–	–	–	–	–	–
CO3	2	2	3	–	–	–	–	–	–	–	–	–	–
CO4	–	2	3	2	2	–	–	–	–	2	–	–	–
CO5	–	2	3	2	2	–	–	–	–	3	–	–	–
AVG	2	2.2	3	2	2	–	–	–	–	2.5	–	–	–

SEC	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 Lab Activities and 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 Hours: 30 Hours
Self Learning: 30Hours

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:

At the end of this course, the students 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

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	–	–	–	3	–	–	–	–	–	–	–	-
CO2	2	3	3	–	2	–	–	–	–	2	–	–	–
CO3	3	2	3	–	3	–	–	–	–	2	–	–	–
CO4	2	3	3	–	3	–	–	–	–	2	–	–	–
CO5	2	3	3	–	2	–	–	–	–	2	–	–	–
AVG	**2.2**	**2.7**	**3**	**–**	**2.6**	**–**	**–**	**–**	**–**	**2**	–	–	**-**