G. Pullaiah College of Engineering and Technology

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA (ECE &EEE) | Affiliated to JNTUA)

Nandikotkur Road, Venkayapalli (V), Kurnool - 518452, Andhra Pradesh

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS
GPCET – R26

B. Tech Regular Four-Year Degree Programme
(For the batches admitted from the academic year 2026- 2027)
&
B. Tech (Lateral Entry Scheme)
(For the batches admitted from the academic year 2027 - 2028)

Preliminary Definitions and Nomenclature

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission(UGC), New Delhi in concurrence with affiliating University (**Jawaharlal Nehru Technological University Anantapur**).

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., one odd and one even.

Branch: Means specialization in a program like B.Tech degree program in Civil Engineering, B.Tech degree program in Computer Science and Engineering etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updating in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., are considered to be foundational in nature.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit-based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Certificate Course: It is a course that makes a student have hands-on expertise and skills required for holistic development in a specific area/field.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student overall the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Detention in a Semester: Student who does not obtain minimum prescribed attendance in a Semester shall be detained in that particular Semester. Also a student can also be detained for lack of required number of credits till II-I/III-I at the end of Second year or Third Year respectively

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal examinations and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means G.Pullaiah College of Engineering and Technology, Kurnool unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOCs inculcate the habit of self-learning. MOOCs would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student registers for another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech); PG degree program: Master of Technology (M.Tech) / Master of Business Administration (MBA).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research-based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech programs offered by Institute, are designated as "GPCET Regulations – R26" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 16 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

Program Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu.

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Academic Regulations (R26) for B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year 2026-27 onwards

1. Award of the Degree

a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

I. Pursues a programme of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

II. Registers for 171 credits and secures all 171 credits.

b) Award of B.Tech. degree with Honors if he/she fulfils the following:

I. Secures additional 18 credits fulfilling all the requisites of a B.Tech. programme i.e., 171 credits.

II. Registering for Honors is optional.

III. Honors is to be completed simultaneously with B.Tech. programme.

C) Award of B.Tech. degree with Minors

I. Student secures additional 18 credits full filling all the requisites of a B.Tech. program i.e., 171 credits.

II. Registering for Minors is optional.

III. Minors is to be completed simultaneously with B.Tech. programme.

2. Students who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. programme and their admission stands cancelled. This clause shall be read along with clause 1 (a) (i).

3. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government /University or any other order of merit approved by the A.P. Government /University, subject to reservations as prescribed by the Government/University from time to time.

4. Program related terms

(a) Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of Teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

(b) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

(c) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses

5. Semester/Credits:

a. A semester comprises of 90 working days and an academic year is divided into two semesters.
b. The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
c. Regular courses may also be completed well in advance through MOOCs satisfying prerequisites

6. Structure of the Undergraduate Programme

All courses offered for the B. Tech programmes are broadly classified as follows

S.No	Category	Breakup of Credits (Total 171)	Percentage of Total Credits	AICTE Recommendation(%)
1	Humanities and Social Science including Management (HM)	15	9%	8-9%
2	Basic Sciences (BS)	22	13%	12-16%
3	Engineering Sciences (ES)	26	15%	10-18%
4	Professional Core (PC)	57	33%	30-36%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	35	20%	19-23%
6	Internships & Project Work (PR)	16	10%	8-11%
7	Mandatory Course (MC)	Non-Credit	Non-Credit	_

The total degree credits become 171, including 2 credits for the online examination. The syllabus for this online examination shall comprise core courses studied by the student up to IV Year – I Semester and this examination will be conducted by the university.

7. Course Classification:

All subjects /courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S. No	Broad	Course Category	Description
1	Foundation Courses	Foundation Courses	Includes Mathematics, Physics and Chemistry; Fundamental Engineering courses; Humanities, Social Sciences and Management courses
2	Core Courses	Professional Core Courses (PC)	Includes subjects related to parent discipline / department / branch of engineering
		Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering

3	Elective Courses	Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific Skill Enhancement Courses (SEC)	Interdisciplinary / Job-oriented / Domain courses which are relevant to the industry
4	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5	Audit Courses	Mandatory non-credit courses	Covering subjects for developing desired attitude among the learners

8. Programme Pattern

i. Total duration of the B. Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90days.
iv. There shall be mandatory Student Induction Program for freshers, with three-week duration before the commencement of first semester. The induction program includes Creative Arts, Universal Human Values, Physical activities, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health / Wellness / Yoga / Sports and NSS / Scouts & Guides / Community Service Activities are mandatory as credit courses for all the undergraduate programmes.
vi. Courses like Environmental Sciences, Indian Knowledge System, Cybersecurity Awareness for Engineers, Gender Sensitization, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking & Tinkering Labs are made mandatory as credit courses for all the undergraduate students. All lateral entry students shall mandatorily complete the Design Thinking course as a Zero-Credit MOOC. The course shall be successfully completed before the award of the degree, preferably by the commencement of the III Year I Semester. The successful completion of the course shall be recorded and reflected in the IV Year II Semester marks memorandum. There shall be Five Professional Elective courses and Four Open Elective courses.
viii. A comprehensive online examination will be conducted in IV Year – I Semester for 2 credits
ix. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
x. Professional Elective Courses include the elective courses relevant to the chosen specialization /branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
xi. A total of 04 Open Electives is offered in the curriculum.
xii. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
xiii. A pool of inter disciplinary /job-oriented /domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses hall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
xiv. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
xv. There shall also be mandatory full internship in the final semester of the programme along with the project work.

xvi. Undergraduate degree with Honors and Minors is introduced by the University for the students having good academic records.

xvii. The College shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provides remote access to labs in various B. Tech Programmes and will help students in learning basic and advanced concepts through remote experimentation. Students shall be made to work on virtual lab experiments during the regular labs.

xviii. The college shall assign a faculty advisor / mentor to a group of students from same department to provide guidance in courses registration / career growth / placements / opportunities for higher studies / GATE / other competitive exams etc.

xix. Preferably 25% of course work for the theory courses in every semester shall preferably be conducted in the blended mode of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated course wise with a maximum of 100 marks for theory and 100 marks for practical courses. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

I. For theory course, the distribution shall be 30 marks for Continuous Internal Assessment and 70 marks for the End Examination.

II. For practical course, the distribution shall be 30 marks for Continuous Internal Assessment and 70 marks for the End Examination.

III. If any course contains two different branch subjects, the syllabus shall be in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

IV. If any subject has both theory and practical components, they will be evaluated separately as theory subject and practical subject.

a) Continuous Internal Evaluation

i. For theory courses, during the semester, there shall be two sessional examinations. Each sessional examination shall be evaluated for 30 marks of which 05 marks for objective paper (10 minutes duration), 20 marks for subjective paper (90 minutes duration) and 05 marks for assignment.

ii. Objective paper shall contain for 05 short answer questions with 1 mark each or maximum of 10 bits for 05 marks. Subjective papers contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 20 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightageof10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the respective institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester, and the average marks shall be considered.

iii. If a student is absent for the sessional examination, no re-exam shall be conducted and the sessional examination marks for that examination shall be considered as zero.

iv. First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weight age given to the better mid exam and 20%to the other.

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

Final mid semester Marks: (25x0.8) +(20x0.2) =24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weight age to the marks secured by the student in the appeared examination and zero to the other.

For Example:

Marks obtained in first mid: Absent

Absent Marks obtained in second mid:25

Final mid semester Marks: (25x0.8) +(0x0.2) =20

b) End Examination Evaluation:

The question paper for the End examination of theory courses shall have the following pattern:

i. There shall be 6 questions and all questions are compulsory.

ii. Question No. 1 shall contain 10 (2 marks each) compulsory short answer questions for a total of 20 marks with 2 short answer questions from each unit.

iii. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question. In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

End Semester Examination Pattern for Theory Courses Consisting of Two Parts of different subjects, such as Basic Electrical & Electronics Engineering, shall follow the pattern:

i. The question paper shall consist of two parts, namely Part-A and Part-B, each carrying 35 marks each.

ii. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

iii. In each part, questions from 2 to 4, there shall be either /or type questions of 10 marks each. Students shall answer any one of them.

iv. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

b) For practical courses, there shall be a continuous assessment during the semester for 30 marksand end examination shall be for 70 marks.

i) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the day-to-day work / record, and 15 marks for the internal test.

ii) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert/external examiner in the subject

Procedure: 20 Marks

Experimental work & Results: 30 marks

Viva voce: 20 marks.

In a practical course consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Internal assessment shall be as above for 30 marks in each part and final internal assessment marks shall be arrived by considering the average of marks obtained in two parts.

iii) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	**Marks**
Continuous Internal Assessment	**30**
Semester End Examination	**70**
Total	**100**

Day-to-day work shall be evaluated for 10 marks by the subject teacher concerned based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 30 marks with weight age of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weight age of 10 marks. The marks obtained in the subjective paper are condensed to 20 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing, multiple branches, etc. is mentioned along with the syllabus.

iv) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and students shall be declared to have passed the mandatory course only when he /she secures 40% or more in internal examinations. In case the student fails, a re-examination shall be conducted for failed candidates for 30marks satisfying the conditions mentioned in item 1&2 of the regulations.

v) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

NOTE

- **The end-semester examinations shall be conducted based on the theoretical components of the prescribed syllabus.**
- **Assignments shall be designed to incorporate AI-integrated elements of the syllabus to promote applied and experiential learning.**
- **The mid-semester examinations may include a combination of both theoretical content and AI-integrated components**

10. Skill Oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill advanced courses from the same domain/Interdisciplinary/Job oriented.

iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70marks.Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity / assignments / viva / mid semester test. The end examination similar to practical examination pattern shall be conducted by the teacher concerned and an expert in the subject nominated by the principal

iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall evaluate the grades/marks given for a course by external agencies and convert them to the equivalent marks/grades. Marks/grades shall be assigned to the students by the above committee based on their performance.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries / Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert them to the equivalent marks/grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.

vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

To promote self-learning and lifelong learning, students are encouraged to enroll in Massive Open Online Courses (MOOCs) offered through **SWAYAM, SWAYAM Plus, and NPTEL** or other University-approved platforms.

A student may earn up to 40% of the total credits prescribed in a semester through MOOCs, subject to the University's guidelines and equivalence requirements.

Further, every student shall mandatorily complete at least one MOOC course before the commencement of the IV-Year II Semester. In addition, the Fifth Professional Elective (PE-V) and the Fourth Open Elective (OE-IV) shall be mandatorily completed through the SWAYAM/SWAYAM Plus platforms. This provision is intended to facilitate students in undertaking the Long-Term Internship during the final semester. Accordingly, every student shall mandatorily complete a total of three MOOC courses for the award of the B.Tech. degree. The following are guidelines for MOOC courses.

i. Students may earn a maximum of 40% of the credits in a semester through MOOCs for PE, OE, and SEC. Further, students of III and IV year are also permitted to pursue Core Courses (CC) through MOOCs.

ii. All the courses for Honors and Minors may be studied through MOOCs platform

iii. Students shall register for MOOCs courses of a minimum duration of either 8 weeks or 12

weeks with the prior approval of the Head of the Department. Credits shall be awarded as follows:

a) 2 credits for an 8-week course
b) 3 credits for a 12-week course

iv. The NCrF rating for the Course is 4.5 for UG program

v. The Head of the Department shall nominate a faculty mentor to monitor the academic progress of students enrolled in MOOCs. It is also responsibility of the mentor to see that the registered subjects is in the approved list provided by the university.

vi. Students shall have the option to choose either the regular offline (classroom) mode or the SWAYAM mode for a particular subject. However, a student shall not be permitted to opt for both modes simultaneously for the same subject. Students opting for SWAYAM shall be exempted from attending regular classroom sessions for that subject, and attendance shall not be counted. Further, Institution should not insist the student to opt SWAYAM course compulsorily.

vii. All students in a class are not required to opt for the same SWAYAM course. Institutions shall arrange regular classes for students opting for offline mode, while the same faculty member may act as a mentor for students enrolled in the SWAYAM course. If all students opt for a SWAYAM course, the subject need not be included in the timetable; however, a mentor shall be assigned to address student queries as per mutual convenience.

viii. Students who completed the prescribed assignments successfully and secured at least 40% of the internal marks shall be permitted to appear for the end-semester examination conducted either by the National Testing Agency (NTA)/NPTEL or by the institution. External examinations shall be held along with regular end-semester examinations, with a weightage of 70% for the end-term examination and 30% for assignments and quizzes evaluated by the SWAYAM Course Coordinator.

ix. Credits shall be awarded only upon submission of a successful course completion certificate. Internal marks obtained through SWAYAM shall be extrapolated to 30 and external marks interpolated to 70 and shall exactly correspond to the marks secured by the student in the SWAYAM course.

x. In case where Institution prescribed passing marks are higher than SWAYAM's minimum requirements, the institute norms shall prevail. In such cases, even if a student submits a SWAYAM certificate but fails to secure the Institute's minimum passing marks, the student shall be declared unsuccessful and must appear for the supplementary examination.

xi. In cases where a student obtains less than the prescribed minimum internal marks (12 out of 30) in a SWAYAM course, and the said course is not offered again in the subsequent semester, the Institute may, through special notification, conduct a full-course supplementary examination for 100 marks during the final semester of the programme. The examination shall be conducted in accordance with the Institute question paper pattern for 70 marks, strictly following the Institute-prescribed syllabus and it will be extrapolated to 100.

xii. For SWAYAM courses where end-term examinations are conducted by the Institute, students shall not be issued a SWAYAM certificate.

xiii. If a SWAYAM course carries more credits than the corresponding course, credit transfer shall be restricted to the number of credits prescribed by Institute to maintain uniformity in total credit requirements. Credit transfer shall not be permitted if the SWAYAM course carries fewer credits than those prescribed by the Institute.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the Institute.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12 Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching - learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Frame work for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 40% of the credits in a semester being offered in a particular programme i .e., via Swayam/Swayam Plus courses through MOOCs platform.

i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution; it is mandatory for the student to share necessary information with the department.
iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
viii) Student pursuing courses under MOOCs shall acquire there quired credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
ix) The institution shall submit the following to the examination section of the university:
  a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
  b) Undertaking form filled in by the students for credit transfer.
x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

13 Academic Bank of Credits (ABC)

The University has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i) Provide option of mobility for learners across the universities of their choice
ii) Provide options to gain credits through MOOCs from approved digital platforms.
iii) Facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv) execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account

14 Mandatory Internships

Summer Internships: Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively, are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and

shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University /Institution shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 marks. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted.

Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project reportson the work carried out during the internship.

The Long-Term Industry Internship undertaken in the final semester (IV Year – II Semester) shall be evaluated for 50 marks by a committee consisting of the Head of the Department along with two senior faculty members of the department. Further, every student shall undertake at least one Industry Visit between the V and VII Semesters, as part of the mandatory internships and practical training requirements

The project report shall be evaluated with an external examiner. The total marks for project work shall be 200 marks (8 credits) and distribution shall be 60 marks for internal assessment and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner (Supervisor); Head of the department and external examiner appointed by the University and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Student Development Program (SDP) – Department-Wise Workshop (Mandatory Non-Credit Course)

Each Department shall design and conduct a **Student Development Programme (SDP)/Department-Wise Workshop** relevant to its discipline for all B.Tech. students. The programme shall carry **Zero Credits** and shall be conducted **at the end of the III B.Tech. I Semester**.

The following guidelines shall govern the conduct and evaluation of the programme:

1. **Programme Planning:** The Head of the Department (HoD) shall prepare and notify the workshop schedule, syllabus/content, learning outcomes, and assessment plan at least **two weeks prior to the commencement** of the programme.
2. **Attendance:** Attendance in all workshop sessions shall be **mandatory**. Students shall attend the programme as per the notified schedule.
3. **Evaluation:** The programme shall be evaluated for a total of **50 marks**, comprising:

- **25 marks** for continuous assessment based on participation, assignments, practical activities, presentations, or other evaluation components prescribed by the Department; and
- **25 marks** for a final examination to be conducted on the **last day of the workshop**.

4. **Pass Requirements:** A student shall be declared to have **successfully completed** the programme only if he/she secures 40% marks in both:
5. **Submission of Marks:** The HoD shall submit the finalized marks list to the **Controller of Examinations, JNTUA, Ananthapuramu**, in the prescribed format within the timeline notified by the University.
6. **Certification:** A **Workshop Completion Certificate** shall be issued only to those students who have successfully fulfilled the prescribed attendance and pass requirements.
7. **Supplementary Examination:** A student who fails to secure the minimum prescribed marks in either the continuous assessment or the final examination shall be required to appear for the **supplementary examination** conducted by the University in the subsequent semester, as per the University rules and schedule.

Successful completion of the **Student Development Programme (SDP)/Department-Wise Workshop** is **mandatory for the award of the B.Tech. degree**, and its completion status shall be reflected in the student's academic records.

16 Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

i) Minors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii) A student shall earn additional 18 credits (comprising 5 theory courses and 2 laboratory/project courses, offered in tracks) for award of B.Tech.(Minors) degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 171 credits).
iii) A student is permitted to register for Minors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Minors from V Semester onwards.
iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Minors program.
v) Courses that are used to fulfil the student's primary major (Open Elective) may not be double counted towards the Minors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Minors.
vi) Students can complete the courses offered under Minors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8-week duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Minors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
vii) The attendance for the registered courses under Minors and regular courses offered or Major degree in a semester are to be considered separately.
viii) A student shall maintain an attendance of 75% in all registered courses under Minors to be eligible for attending semester end examinations.
ix) A student registered for Minors shall pass in all subjects that constitute the requirement for the Minors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Minors degree programme.
x) If a student drops or is terminated from the Minors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xi) The Minors will be mentioned in the degree certificate. Every engineering department in the institution shall offer minor program and A Minor course on Quantum Computing shall be offered for all branches, with the curriculum framed by the CSE Department.

xii) A student who fails in any course of the Minor Programme shall be permitted to appear for the corresponding supplementary examination(s) as per the University rules. However, the student shall successfully complete all the prescribed courses of Minor program before Completion of Major Degree Programme. Failure to do so shall result in the cancellation of admission to the Minor Programme, and no Minor credential shall be awarded.

xiii) All the courses offered under Minor may also be pursued through MOOCs. The Bloom's Taxonomy level for Minor courses shall be 3 and below

17 Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. B. Tech (Hons.) is the best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) Students with CGPA of 7 and no back logs upto2nd year I semester are eligible to register for honors programs.

iii) A studentshallearnadditional18credits (comprising 5 theory courses and 2 laboratory/project courses, offered in tracks) for award of B.Tech.(Honors)degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 171 credits).

iv) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester per training to the Honors from V Semester onwards.

v) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.

vi) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vii) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

viii) The attendance for the registered courses under Honors and regular coursesofferedforMajordegreeinasemesteraretobeconsideredseparately.

ix) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

x) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second-class, first class and distinction, etc.) shall be awarded for Honors degree programme.

xi) Registration for honors program continues even if the student fails in any of the regular courses after his registration to honors course.

xii) A student who fails in any course of the Honor Programme shall not be permitted to write the supplementary examination and the registration for the Honor Programme will be cancelled.

xiii) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional

courses completed by them.

xiv) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

xv) All the courses offered under Honors may also be pursued through MOOCs. The Bloom's Taxonomy level for Honors courses shall be 3 and above,

Enrolment into Honors:

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

ii) The enrolment of students into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7.0 CGPA without any backlog subjects will be permitted to register for Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors/Minors:

i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors/Minors.

ii) The students enrolled in the Honors/Minors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iii) There is no fee for registration of subjects for Honors/Minors program offered in offline at the respective institutions.

Failure & Supplementary Examination Procedure for Honors/Minors Courses:

i) Time Limit for Completion:
The student must successfully complete all Honours/ Minors courses within the regular period of study applicable to the B.Tech. programme.

ii) Cancellation of Honours/ Minors Registration:
If the student fails to complete all Honours requirements within the stipulated regular period of study, the Honours/ Minors registration shall stand cancelled, and the additional credits earned shall remain extra. These credits should not be counted for the award of the major Degree

18 Attendance Requirements:

i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek read mission for that semester from the date of commencement of class work.

vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be

eligible for re admission into the same class.

vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

viii) For induction programme attendance shall be maintained as per AICTE norms.

ix) Attendance in SWAYAM courses shall be excluded from the calculation of the student's overall attendance requirement for the semester.

19 Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per the norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off to lower*** digit) up to in the courses that have been studied up to III semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off to lower*** digit) in the courses that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by (ii) & (iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

20 Grading:

As a measure of student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	**Grade**		**Grade points Assigned**
90 & above	S	Superior	10
80 - 89	A	Excellent	9
70 - 79	B	Very Good	8
60 - 69	C	Good	7
50 - 59	D	Average	6
40 - 49	E	Below Average	5
< 40	F	Fail	0
Absent	Ab	Absent	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the

letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade point scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\mathbf{SGPA = \Sigma(Ci \times Gi)/\Sigma Ci}$$

Where, Ci is the number of credits of the i^{th} subject and Gi is the grade point scored by the student in the i^{th} course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$\mathbf{CGPA = \Sigma(Ci \times Si)/\Sigma Ci}$$

Where "Si" is the SGPA of the i^{th} semester and Ci is the total number of credits up to that semester.

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

While computing the SGPA the courses in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course.

Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student satisfies the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.5 < 5.5

Both CGPA and Marks shall be given in marks memos.

21 With–holding of Results

If the candidate has any dues not paid to the institution or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

22 Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first / second / third year.

i) **UG Certificate (in Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, followed by an additional exit 10- credit bridge course(s) lasting two months, including at least 6- credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, followed by an additional exit 10- credit bridge course(s) lasting two months, including at least 6 - credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., B.Sc. Engineering in (Field of study/discipline) - Programme duration: First three years (first six semesters) of the

undergraduate programme.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Institution/University shall resolve any issues that may arise in the implementation of MultipleEntry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

23 Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee constituted by the principal shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

24 Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining in the succeeding year of their B. Tech from the date of commencement of class work, and they will follow the academic regulations into which they are readmitted

25 Minimum Instruction Days:

The minimum instruction days including exams for each semester shall be 90 days.

26 Medium of Instruction:

The medium of instruction of the entire B. Tech programme (including examinations and project reports) will be in English only

27 Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

28 General Instructions:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices rules-nature and punishments are appended.
iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
v. The Universities may change or amend the academic regulations or syllabi at any time, and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor/Head of the institution is final.

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ACADEMIC REGULATIONS (R26)

FOR B.TECH.(LATERAL ENTRY SCHEME)

*(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2027-28**onwards)*

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

(i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would be in addition to the maximum period permitted for graduation (Six years).

(ii) Registers for 131 credits and secures all 131 credits.

(b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:

(i) Student secures additional 18 credits, fulfilling all the requisites of a B.Tech. program i.e., 131 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

(c) Award of B.Tech. degree with Minors

(i) Student secures additional 18 credits, fulfilling all the requisites of a B.Tech. program i.e., 131 credits.

(ii) Registering for Minors is optional.

(iii) Minors is to be completed simultaneously with B.Tech. programme.

2. Students who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. All lateral entry students shall mandatorily complete the Design Thinking course as a Zero-Credit MOOC. The course shall be successfully completed before the award of the degree, preferably by the commencement of the III Year I Semester. The successful completion of the course shall be recorded and reflected in the IV Year II Semester marks memorandum.

4. Course Pattern

i) The entire course of study is three academic years on semester pattern.

ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5 All other academic regulations, including those relating to attendance, examinations, promotion, evaluation, and the award of the degree, shall be the same as those prescribed for regular B.Tech. students, unless otherwise specified

RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, notebook, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police, and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police, and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police, and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.
12	Tampering of the NPTEL/SWAYAM/SWAYAM certificate	Cancellation of student performance in the entire semester
13.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractice)
3. A show cause notice shall be issued to the college.
4. Impose a suitable fine on the college.
5. Shifting the examination centre from the college to another college for a specific period of not less than one year.

Note: -

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil all the norms required for the award of Degree.

0 SEMESTER (INDUCTION PROGRAM)						
S.No	Course	Category	Periods per Week			Credits
			L	T	P	
1	Physical Activities - Sports, Yoga and Meditation, Plantation	MC	0	0	6	0
2	Career Counselling	MC	2	0	2	0
3	Orientation to all branches -- career options, tools, etc.	MC	3	0	0	0
4	Orientation on admitted Branch --corresponding labs, tools and platforms	EC	2	0	3	0
5	Proficiency Modules & Productivity Tools	ES	2	1	2	0
6	Assessment on basic aptitude and mathematical skills	MC	2	0	3	0
7	Remedial Training in Foundation Courses	MC	2	1	2	0
8	Human Values & Professional Ethics	MC	3	0	0	0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2	1	2	0
10	Concepts of Programming	ES	2	0	2	0

I SEMESTER (I YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT101	Linear Algebra and Calculus	BS	3	0	2	0	4	30	70	100
26PHY107	Physics for Communication Systems	BS	3	0	0	0	3	30	70	100
26CSE101	Computational Thinking and Problem Solving with Python	ES	3	0	0	0	3	30	70	100
26ENG101	Communicative English	HM	2	0	0	0	2	30	70	100
26CAI101	AI Tools and Applications	ES	1	0	4	0	3	30	70	100
26PHY108	Physics for Communication Systems Lab	BS	0	0	0	3	1.5	30	70	100
26CSE102	Computational Thinking and Problem Solving with Python Lab	ES	0	0	0	3	1.5	30	70	100
26ENG102	Communicative English Lab	HM	0	0	0	2	1	30	70	100
26HSM103	Health and wellness, Yoga and Sports	HM	0	0	0	1	0.5	-	100	100
26CSE103	Cybersecurity Awareness for Engineers	MC	2	0	0	0	0	100*	-	100*
		TOTAL	**14**	**0**	**6**	**9**	**19.5**	**240**	**660**	**900**

* The marks for Mandatory Courses are not considered for calculating SGPA

II SEMESTER (I YEAR)										
Cours Code	Title of the Course	Category	Periods perWeek				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT201	Differential Equations & Vector Calculus	BS	3	0	2	0	4	30	70	100
26CHE207	Engineering Chemistry for Electronics and Communication Systems	BS	3	0	0	0	3	30	70	100
26MEC101	Engineering Graphics	ES	1	0	4	0	3	30	70	100
26EEE203	Network Analysis	PC	3	0	0	0	3	30	70	100
26HSM101	Design Thinking	HM	1	0	4	0	3	30	70	100
26ECE201	Electronics and Electrical Engineering Workshop	PC	0	0	0	2	1	30	70	100
26MEC102	Engineering Workshop	ES	0	0	0	3	1.5	30	70	100
26CHE208	Engineering Chemistry for Electronics and Communication Systems Lab	BS	0	0	0	3	1.5	30	70	100
26HSM102	NSS/NCC/Scouts & Guides/ Community Service	HM	0	0	0	1	0.5	30	70	100
		TOTAL	11	0	10	09	20.5	270	630	900

III SEMESTER (II YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Basic Sciences Course	BS	3	0	0	0	3	30	70	100
	Humanities Course	HM	3	1	0	0	3	30	70	100
	Humanities Course	HM	2	0	0	0	2	30	70	100
	Engineering Course	ES	3	0	0	0	3	30	70	100
	Professional Core 2	PC	2	0	2	0	3	30	70	100
	Professional Core 3	PC	2	0	2	0	3	30	70	100
	Engineering Course Lab	ES	0	0	0	2	1	30	70	100
	Professional Core 2 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 3 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement course-I	SEC	1	0	0	2	2	30	70	100
	Audit Course	MC	2	0	0	0	-	100*	-	100*
	TOTAL		**18**	**0**	**4**	**10**	**23**	**300**	**700**	**1000**

* The marks for Mandatory Courses are not considered for calculating SGPA

IV SEMESTER (II YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Humanities Course	HM	2	0	0	0	2	30	70	100
	Engineering Course	ES	1	0	2	0	2	30	70	100
	Professional Core 4	PC	2	0	2	0	3	30	70	100
	Professional Core 5	PC	2	0	2	0	3	30	70	100
	Professional Core 6	PC	2	0	2	0	3	30	70	100
	Professional Core 7	PC	2	0	2	0	3	30	70	100
	Professional Core 4 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 5 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement course-II	SEC	1	0	0	2	2	30	70	100
	Audit Course	MC	2	0	0	0	0	100*	-	100*
	TOTAL		**14**	**0**	**10**	**08**	**21**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation after II year II semester										

V SEMESTER (III YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Core 8	PC	2	0	2	0	3	30	70	100
	Professional Core 9	PC	2	0	2	0	3	30	70	100
	Professional Core 10	PC	2	0	2	0	3	30	70	100
	Professional Core 11	PC	2	0	2	0	3	30	70	100
	Systems Thinking and Interdisciplinary Engineering	ES	2	0	0	0	2	30	70	100
	Introduction to Quantum Technologies and Applications	SEC	2	0	0	0	2	30	70	100
	Professional Core 8 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 9 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement Course III (Soft Skills)	HM	1	0	0	2	2	30	70	100
	Evaluation of Community Service Internship	PW	0	0	0	0	2	100	-	100
	Tinkering Lab	BS	0	0	0	2	1	30	70	100
		TOTAL	13	0	8	10	24	400	700	1100

* The Student Development Program (Workshop) shall be conducted at the end of the III Year I Semester and its
outcomes will be reflected in the III Year II Semester
* Mandatory Industry visit in any one of V to VII semester

VI SEMESTER (III YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Core 12	PC	2	0	2	0	3	30	70	100
	Professional Core 13	PC	2	0	2	0	3	30	70	100
	Professional Elective I	PE	3	0	0	0	3	30	70	100
	Professional Elective II	PE	3	0	0	0	3	30	70	100
	Open Elective I	OE	3	0	0	0	3	30	70	100
	Professional Core 12 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 13 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement Course IV	SEC	1	0	0	2	2	30	70	100
	Entrepreneurship and Ecosystem	HM	2	0	0	0	2	30	70	100
	Indian Knowledge System	MC	2	0	0	0	0	100*	-	100*
	Student Development Program (Workshop)	PC	0	0	0	0	0	30	70	100
		TOTAL	18	0	4	08	22	270	630	900
Mandatory Industry Internship of 08 weeks duration during summer vacation										

V SEMESTER (III YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Core 8	PC	2	0	2	0	3	30	70	100
	Professional Core 9	PC	2	0	2	0	3	30	70	100
	Professional Core 10	PC	2	0	2	0	3	30	70	100
	Professional Core 11	PC	2	0	2	0	3	30	70	100
	Systems Thinking and Interdisciplinary Engineering	ES	2	0	0	0	2	30	70	100
	Introduction to Quantum Technologies and Applications	SEC	2	0	0	0	2	30	70	100
	Professional Core 8 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 9 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement Course III (Soft Skills)	HM	1	0	0	2	2	30	70	100
	Evaluation of Community Service Internship	PW	0	0	0	0	2	100	-	100
	Tinkering Lab	BS	0	0	0	2	1	30	70	100
		TOTAL	13	0	8	10	24	400	700	1100

* The Student Development Program (Workshop) shall be conducted at the end of the III Year I Semester and its outcomes will be reflected in the III Year II Semester

* Mandatory Industry visit in any one of V to VII semester

VI SEMESTER (III YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Core 12	PC	2	0	2	0	3	30	70	100
	Professional Core 13	PC	2	0	2	0	3	30	70	100
	Professional Elective I	PE	3	0	0	0	3	30	70	100
	Professional Elective II	PE	3	0	0	0	3	30	70	100
	Open Elective I	OE	3	0	0	0	3	30	70	100
	Professional Core 12 Lab	PC	0	0	0	3	1.5	30	70	100
	Professional Core 13 Lab	PC	0	0	0	3	1.5	30	70	100
	Skill Enhancement Course IV	SEC	1	0	0	2	2	30	70	100
	Entrepreneurship and Ecosystem	HM	2	0	0	0	2	30	70	100
	Indian Knowledge System	MC	2	0	0	0	0	100*	-	100*
	Student Development Program (Workshop)	PC	0	0	0	0	0	30	70	100
		TOTAL	18	0	4	08	22	270	630	900
Mandatory Industry Internship of 08 weeks duration during summer vacation										

VII SEMESTER (IV YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Core 14	PC	2	0	2	0	3	30	70	100
	Management Course	HM	2	0	0	0	2	30	70	100
	Professional Elective III	PE	3	0	0	0	3	30	70	100
	Professional Elective IV	PE	3	0	0	0	3	30	70	100
	Open Elective II	OE	3	0	0	0	3	30	70	100
	Open Elective III	OE	3	0	0	0	3	30	70	100
	Skill Enhancement Course V	SEC	1	0	0	2	2	30	70	100
	Audit Course Gender Sensitization	MC	2	0	0	0	0	100*	-	100*
	Evaluation of Industry Internship	PR	0	0	0	0	2	-	100	100
	Online Examination	PC	0	0	0	0	2	-	100	100
		TOTAL	19	0	2	2	23	210	690	900

* The marks for Mandatory Courses are not considered for calculating SGPA

VIII SEMESTER (IV YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Professional Elective V (MOOCS)	PE	3	0	0	0	3	30	70	100
	Open Elective IV (MOOCS)	OE	3	0	0	0	3	30	70	100
	Internship	PR	0	0	0	0	4	-	100	100
	Project	PR	0	0	0	0	8	60	140	200
		TOTAL	6	0	0	0	18	120	380	500

I SEMESTER (I YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT101	Linear Algebra and Calculus	BS	3	0	2	0	4	30	70	100
26PHY107	Physics for Communication Systems	BS	3	0	0	0	3	30	70	100
26CSE101	Computational Thinking and Problem Solving with Python	ES	3	0	0	0	3	30	70	100
26ENG101	Communicative English	HM	2	0	0	0	2	30	70	100
26CAI101	AI Tools and Applications	ES	1	0	4	0	3	30	70	100
26PHY108	Physics for Communication Systems Lab	BS	0	0	0	3	1.5	30	70	100
26CSE102	Computational Thinking and Problem Solving with Python Lab	ES	0	0	0	3	1.5	30	70	100
26ENG102	Communicative English Lab	HM	0	0	0	2	1	30	70	100
26HSM103	Health and wellness, Yoga and Sports	HM	0	0	0	1	0.5	-	100	100
26CSE103	Cybersecurity Awareness for Engineers	MC	2	0	0	0	0	100*	-	100*
		TOTAL	**14**	**0**	**6**	**9**	**19.5**	**240**	**660**	**900**

* The marks for Mandatory Courses are not considered for calculating SGPA

LINEAR ALGEBRA AND CALCULUS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	2	0	42	0	28	0	4	30	70	100

1. Course Objectives

- Build strong foundations in linear algebra and multivariable calculus with direct engineering relevance.
- Integrate analytical methods with AI-assisted computational tools for visualization, simulation, and verification.
- Develop outcome-oriented problem-solving skills aligned with NEP 2020 and modern engineering applications.
- Apply matrix methods, eigenanalysis, and multivariable calculus to solve engineering problems.
- Use computational tools for approximation, optimization, differentiation, and integration.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Apply matrix algebra techniques to Solve systems of linear equations using matrix algebra, elimination techniques, and iterative methods, while leveraging computational tools for large-scale systems.	L3 (Apply)
CO2	Analyze eigenvalue problems, diagonalization, and quadratic forms to interpret linear transformations and engineering systems.	L4 (Analyze)
CO3	Apply mean value theorems and polynomial approximations (Taylor and Maclaurin series) to evaluate functions and estimate errors.	L3 (Apply)
CO4	Analyze multivariable functions using partial derivatives, Jacobians and optimization techiniques.	L4 (Analyze)
CO5	Evaluate areas, volumes, and coordinate transformations using multiple integrals in engineering contexts.	L5 (Evaluate)

3. Course Syllabus

UNIT I: Matrix Algebra and Linear Systems

Core Content: Matrices, types of matrices, operations, transpose, inverse, symmetric and skew-symmetric matrices; determinant properties; rank of a matrix; echelon and normal forms; system of linear equations; consistency conditions; Gauss elimination and Gauss-Jordan methods; iterative methods: Jacobi and Gauss-Seidel; Cramer's rule; matrix inversion method.

AI Integration: Python-based solution of large linear systems using NumPy; visualization of convergence in iterative methods; AI-assisted debugging of matrix algorithms; using ChatGPT/Copilot to explain row operations and rank reduction.

Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib) on Google Colab; SymPy for symbolic matrix operations; Jupyter Notebook; Scilab.

UNIT II: Eigenvalues, Eigenvectors, Diagonalization & Quadratic Forms

Core Content: Eigenvalues and eigenvectors; characteristic equation; Cayley-Hamilton theorem; powers and inverse of matrices using Cayley-Hamilton theorem; diagonalization; similarity transformation; quadratic forms; canonical form; reduction by orthogonal transformation; rank, index, signature; positive definite forms; orthogonal, Hermitian, skew-Hermitian and unitary matrices.

AI Integration: AI-assisted eigenvalue computation and verification; Python/SciPy visualization of eigenmodes and quadratic surfaces; use of AI tools to explain diagonalization and matrix classification; numerical checking of Cayley-Hamilton theorem.

Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib); SymPy; GNU Octave; Google Colab.

UNIT III: Single Variable Calculus and Series Expansions

Core Content: Rolle's theorem; Lagrange's mean value theorem; Cauchy's mean value theorem; Taylor's and Maclaurin's series with remainder; approximation of functions; error estimation.

AI Integration: SymPy-based Taylor and Maclaurin expansion generation; plotting truncation error and convergence; AI-supported derivation checking for mean value theorems.

Free/Open-Source AI Tools: Python (SymPy, NumPy, Matplotlib); Google Colab; Jupyter Notebook; WolframAlpha free tier for verification.

UNIT IV: Multivariable Differentiation and Optimization

Core Content: Functions of several variables; limits and continuity; partial derivatives; higher order partial derivatives; total derivative; chain rule; Jacobians; functional dependence; Taylor expansion of two-variable functions; maxima and minima; second derivative test; Lagrange multipliers and constrained optimization.

AI Integration: Series expansion visualization using Python; AI-assisted Jacobian computation and verification; constrained optimization using SciPy; use of AI tools to interpret saddle points, extrema, and optimization constraints.

Free/Open-Source AI Tools: Python (NumPy, SciPy, SymPy, Matplotlib); Google Colab; Jupyter Notebook; SciPy optimize module.

UNIT V: Multiple Integrals and Coordinate Transformations

Core Content: Double integrals; evaluation over type I and type II regions; change of order of integration; triple integrals; change of variables; polar, cylindrical and spherical coordinates; area and volume computation.

AI Integration: Numerical evaluation of double and triple integrals using SciPy; 2D and 3D region visualization; AI-assisted generation of integration code; interpreting Jacobian as geometric scaling factor in transformed coordinates.

Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib); Google Colab; SymPy; Jupyter Notebook; 3D plotting tools.

Course Outcomes (COs)

4. Books and Materials

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley, 2018.
3. G. B. Thomas, M. D. Weir, J. Hass, Thomas' Calculus, 14th Edition, Pearson, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5th Edition, Alpha Science International, 2021.

Reference Books:

1. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press, 2016.
2. David C. Lay, Steven R. Lay, Judi J. McDonald, Linear Algebra and Its Applications, 5th Edition, Pearson, 2015.
3. George B. Arfken, Hans J. Weber, Frank E. Harris, Mathematical Methods for Physicists, 7th Edition, Academic Press, 2012.
4. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 6th Edition, Jones & Bartlett, 2018.
5. E. Kreyszig, Elementary Linear Algebra, 2nd Edition, Wiley, 1983.

Web Resources & NPTEL Links:

- NPTEL: Linear Algebra – https://nptel.ac.in
- MIT OpenCourseWare – Linear Algebra: https://ocw.mit.edu
- MIT OpenCourseWare – Multivariable Calculus: https://ocw.mit.edu

- Python SymPy Documentation: https://docs.sympy.org
- Google Colab for Python: https://colab.research.google.com
- SciPy Documentation: https://docs.scipy.org
- NumPy Documentation: https://numpy.org/doc
- Recommended Free & Open-Source AI/Computational Tools
- Python (NumPy, SciPy, Matplotlib) – FREE on Google Colab for matrix computation, visualization, and numerical analysis.
- SymPy (free, open-source) – for symbolic algebra, calculus, matrix operations, and verification.
- scikit-learn (free, open-source) – for regression, classification, and exploratory predictive modeling.
- Jupyter Notebook (free, open-source) – for interactive computation and lab documentation.
- OpenCV (free, open-source) – for image-based experimentation and visualization support where needed.
- GNU Octave (free, open-source) – MATLAB-like numerical computing for matrix and calculus workflows.
- TensorFlow / Keras (free, open-source) – for optional AI demonstrations in regression and classification tasks.

PHYSICS FOR COMMUNICATION SYSTEMS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	0	0	42	0	0	0	3	30	70	100

1. Course Objectives

- To provide knowledge on wave optics concepts such as interference, diffraction, and polarization with basic AI-assisted optical analysis applications.
- To equip students the fundamentals of quantum mechanics and quantum computing with basic AI-assisted secure communication concepts.
- To introduce lasers, fiber optics, and advanced sensing technologies with simple AI-assisted communication and signal processing techniques.
- To familiarize students with electrical properties of metals and semiconductors using AI-assisted material and conductivity analysis methods.
- To impart knowledge on electromagnetic field theory and its applications with basic AI-assisted antenna and RFID system concepts.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Apply the principles of interference, diffraction, polarization, along with basic AI-assisted optical analysis in engineering applications.	L3 (Apply)
CO2	Apply the concepts of quantum mechanics and quantum computing along with basic AI-assisted secure communication applications.	L3 (Apply) L4(Analyze)
CO3	Analyze the working of lasers, fiber optics, and advanced sensing systems along with basic AI-assisted optical communication and signal processing techniques..	L4 (Analyze) L5 (Evaluate)
CO4	Analyze the electrical properties of metals and semiconductors, along with basic AI-assisted material characterization and conductivity analysis methods	L4 (Analyze) L5 (Evaluate)
CO5	Apply Maxwell's equations and electromagnetic field concepts along with AI-assisted RFID and antenna-based systems.	L3 (Apply) L4 (Analyze)

3. Course Syllabus

UNIT-I: Wave Optics and Quantum Information Processing

Core Content:

Interference: Principle of superposition and coherence, Interference, Types of interference, Interference in thin films (reflection geometry) and Newton's rings. Applications: Determination of wavelength and refractive index.

Diffraction: Introduction to diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to single and double slits, Diffraction Grating, Dispersive power and Resolving power of grating. Applications: CD/DVD data storage, Barcode scanners.

Polarization: Types of polarization, Nicol's prism, Half-wave and Quarter-wave plates.

AI Integration:

AI-assisted polarization management for quantum key distribution. AI-integrated holographic interferometry for surface flatness analysis.

Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib and scikit-learn).

UNIT-II: Introduction to Quantum Mechanics & Quantum Computing

Core Content:

Introduction to quantum mechanics, de-Broglie concept (matter waves), Heisenberg's Uncertainty Principle,Postulates of Quantum Mechanics, Schrödinger's time-independent wave equation, Physical Significance of Wavefunction,Particle in a one-dimensional potential well, Quantum tunnelling (basic idea).

Introduction to Quantum Computing: Classical bits vs Qubits. Concept of superposition and Entanglement, Basic Quantum Operations: Hadamard gate (idea of superposition), Pauli-X gate. Basic idea of quantum measurement. Applications (qualitative only): AI-Assisted Tunnel Diodes and cold emission of electrons, Basic idea of quantum cryptography and secure communication.

AI Integration: AI-Assisted Analysis of Tunnel Diode Characteristics using Quantum Tunnelling Concepts, AI-Assisted Quantum Key Distribution for Secure Communication

Free/Open-Source AI Tools: Google Colab, Python and Scikit-learn.

UNIT-III: Quantum Photonics and Advanced Sensing

Core Content:

Lasers: Interaction of radiation with matter, Requisites and conditions for laser action, He-Ne laser, Nd-YAG laser, Laser-based data communication, Optical data storage, Photonic computing basics, Applications of lasers.

Fiber Optics: Propagation mechanism, Numerical aperture, Acceptance angle, Types of optical fibres, Classifications and Modes of optical fibres, V-Number, Attenuation in optical fibers, - Distributed Fiber Optic Sensing (DFOS) with AI-Powered Signal Analysis.

AI Integration:

AI-powered signal analysis for distributed fiber optic sensing. Python simulation of laser propagation and fiber optic signal attenuation.

Free/Open-Source AI Tools: Google Colab, Python, NumPy, SciPy and Scikit-learn/ TensorFlow.

UNIT IV: Electrical Properties of Metals and Semiconductors

Core Content:

Classical free electron theory – merits and demerits; Quantum free electron theory – merits and demerits, Fermi-Dirac statistics, Fermi level and variation with temperature, Classification of solids – metals, insulators and semiconductors.

Semiconductors: Introduction, Fermi level in intrinsic and extrinsic semiconductors, Expression for concentration of electrons in conduction band and holes in valence band and Charge carrier concentration in intrinsic semiconductors, Electrical conductivity in intrinsic semiconductors, Expressions for drift and diffusion currents, Hall effect, Expression for Hall coefficient and its applications

AI Integration: AI-Assisted Prediction of Electrical Conductivity in Metals and Semiconductors, AI-Assisted Carrier Concentration and Conductivity Analysis in Semiconductors.

Free/Open-Source AI Tools: Google Colab, Python and Scikit-learn.

UNIT V: Introduction to EM Theory

Core Content:

Introduction, wave equation in differential form in free space, Vector analysis, Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem and Stokes' theorem. Derivations of the four Maxwell equations and their significance, Energy transport and Poynting Vector. Applications: Radio Frequency Identification (RFIDs) and Antennas.

AI Integration: AI-Assisted RFID-Based Smart Tracking and Identification Systems, AI-Assisted Fault Detection in Antenna Systems,

4. Books and Materials

Textbooks:

1. Avadhanulu, Kshirsagar&Arun Murthy, A Textbook of Engineering Physics, S. Chand, 2019.
2. D. K. Bhattacharya & Poonam Tandon, Engineering Physics, Oxford Press, 2015.

Reference Books:

1. B. K. Pandey & S. Chaturvedi, Engineering Physics, Cengage Learning, 2021.
2. Shatendra Sharma &Jyotsna Sharma, Engineering Physics, Pearson, 2018.
3. D. J. Griffiths, Introduction to Quantum Mechanics, Cambridge Press.
4. Saleh & Teich, Fundamentals of Photonics, Wiley.
5. Streetman & Banerjee, Solid State Electronic Devices, Pearson.
6. C. Kittel, Introduction to Solid State Physics, Wiley.

Web Resources & NPTEL Links

- NPTEL – nptel.ac.in
- MIT OpenCourseWare – ocw.mit.edu
- HyperPhysics – hyperphysics.phy-astr.gsu.edu
- Feynman Lectures – feynmanlectures.caltech.edu
- PhET Simulations – phet.colorado.edu

Recommended Free & Open-Source AI/Computational Tools

- Python (NumPy, SciPy, OpenCV, Matplotlib) – FREE on Google Colab for optics and EM simulations
- IBM Qiskit (free, open-source) – For quantum computing and quantum cryptography simulations
- scikit-learn (free, open-source) – For semiconductor data analysis and signal classification
- OpenEMS (free, open-source) – For electromagnetic field simulation and antenna design
- PhET Interactive Simulations (free) – For wave optics, semiconductors and quantum phenomena

COMPUTATIONAL THINKING AND PROBLEM SOLVING WITH PYTHON

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	0	0	42	0	0	0	3	30	70	100

1. Course Objectives

- Introduce students to computational thinking and problem-solving techniques.
- Develop the ability to design algorithms, flowcharts, and pseudocode.
- Provide foundational knowledge of Python programming — data types, operators, and I/O.
- Enable students to implement logic using control structures and data structures.
- Develop skills in modular programming, file handling, and basic OOP concepts.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Apply computational thinking concepts to design algorithms, flowcharts, and basic Python programs. (L3)	L3 (Apply)
CO2	Develop programs using decision-making and looping constructs to solve logical problems. (L3)	L3 (Apply)
CO3	Analyse and manipulate data using strings, lists, tuples, and sets for problem solving. (L4)	L4 (Analyse)
CO4	Design modular programs using functions, recursion, and dictionaries to improve code reusability. (L4)	L4 (Analyse)
CO5	Implement file handling, exception handling, and basic object-oriented programming concepts in Python applications. (L3)	L3 (Apply)

3. Course Syllabus

UNIT I: Computational Thinking and Programming Basics

Core Content: Computational thinking: characteristics, problem-solving strategies, steps in problem solving; algorithms — definition and properties; flowcharts — symbols and construction; pseudocode — writing and conversion; abstraction, decomposition, pattern recognition, algorithm efficiency basics.
Introduction to Python: installation and execution environment; variables, identifiers, keywords; data types, type conversion; input and output statements; expressions and operators — arithmetic, relational, logical, assignment; operator precedence.
AI Integration: Use Flowgorithm to design and simulate algorithms (e.g., largest of 3 numbers); draw flowcharts using Lucidchart; use Algorithm Visualizer to trace algorithm execution; use ChatGPT to convert pseudocode to Python and verify output.

UNIT II: Decision Making and Looping

Core Content: Decision control statements: Boolean expressions; if, if-else, if-elif-else, nested if; conditional expressions (ternary operator).
Looping statements: while loop, for loop, iteration techniques, nested loops, infinite loops; loop control — break, continue, pass; else with loops.
Practical problem solving: prime number check, pattern programs using nested loops, menu-driven programs using control statements.
AI Integration: Use Python Tutor to visualize if-else and loop execution step by step; use Thonny to debug loop-based programs; use Replit Decision control statements: Boolean expressions; if, if-else, if-elif-else, nested if; conditional expressions (ternary operator).
Looping statements: while loop, for loop, iteration techniques, nested loops, infinite loops; loop control — break, continue, pass; else with loops.

Practical problem solving: prime number check, pattern programs using nested loops, menu-driven programs using control statements.

UNIT III: Strings and Data Structures

Core Content: Strings: representation, indexing, slicing, operations, built-in functions and methods. Lists: creation, indexing and slicing, operations, functions, methods, nested lists.

Tuples: creation, operations, packing and unpacking. Sets: creation, set operations — union, intersection, difference; frozen sets.

AI Integration: Use NLTK and TextBlob to perform text analysis (sentiment, word frequency) on strings; use Pandas and NumPy for list and array operations; use ChatGPT to explain string slicing and list comprehensions with concrete examples.

UNIT IV: Functions and Problem Solving

Core Content: Dictionaries: creation, operations, methods; dictionary-based applications.

Functions: built-in and user-defined functions; function definition and calling; arguments — positional, keyword, default, variable-length; scope of variables (local and global).

Recursion: recursive functions — factorial, Fibonacci; lambda functions (anonymous functions); applications of functions in problem solving

AI Integration: Use Jupyter Notebook for interactive function experiments; use SymPy for symbolic mathematical expressions; use PyCharm for modular program development; use ChatGPT to trace recursive function calls step by step.

UNIT V: File Handling, Exception Handling, AND OOP

Core Content: Modules and packages: creating and importing modules; standard library modules. File handling: opening, reading, writing, and closing files; file modes; working with text files; processing CSV and Excel files. Exception handling: types of errors (syntax, runtime, logical); try, except, finally blocks; raising exceptions. Introduction to OOP: classes, objects, attributes, methods, constructors, self keyword; basic applications of OOP in Python)

AI Integration: Use Pandas and OpenPyXL to read and write CSV/Excel files; use Pytest for testing exception handling; use ChatGPT to explain OOP class design with real-world examples; use Django for a simple mini web application as a capstone project.

4. Books and Materials

Textbooks

1. TB1: Pieter Spronck, Computational Thinking with Python, (course textbook — covers computational thinking, algorithms, and Python programming).
2. TB2: Reema Thareja, Programming in Python, Oxford University Press. (Primary implementation reference — all five units.)

Reference Books

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media. (Free at greenteapress.com)
2. Eric Matthes, Python Crash Course, 2nd Edition, No Starch Press.

Online Resources

- Algorithm & Flowchart: Flowgorithm – flowgorithm.org | Lucidchart – lucidchart.com | Algorithm Visualizer – algorithm-visualizer.org
- Programming & Debugging: Python Tutor – pythontutor.com | Thonny – thonny.org | Replit – replit.com
- Data & Scientific: Pandas – pandas.pydata.org | NumPy – numpy.org | SymPy – sympy.org
- NLP & Text: NLTK – nltk.org | TextBlob – textblob.readthedocs.io
- Development: Jupyter Notebook – jupyter.org | PyCharm – jetbrains.com/pycharm | OpenPyXL – openpyxl.readthedocs.io
- NPTEL – Problem Solving through Programming in C / Python – nptel.ac.in

COMMUNICATIVE ENGLISH

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
2	0	0	0	28	0	0	0	2	30	70	100

1. Course Objectives

- Build a solid foundation in core English grammar, vocabulary, phonetics, and communication frameworks tailored for the workplace.
- Strengthen listening, speaking, reading, and writing abilities through interactive exercises and AI-driven platforms.
- Craft polished professional emails, reports, and presentations with the assistance of AI writing tools.
- Analyse communication patterns, structural barriers, and discourse using AI analytical tools.
- Practice ethical AI use by fact-checking generated content, upholding academic honesty, and leveraging AI as a learning aid rather than a replacement for critical thought.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Apply fundamental rules of English grammar, syntax, and communication dynamics, utilizing AI-driven tools to enhance language accuracy, real-time feedback, and vocabulary acquisition.	L1 (Remember) L2 (Understand)
CO2	Demonstrate effective oral communication, active listening, and persuasive presentation skills in group discussions, debates, and public speaking, while leveraging AI tools for real-time speech analysis and dynamic visual content creation.	L2 (Understand)
CO3	Apply diverse reading strategies, expand academic vocabulary, and draft structured written texts—ranging from paragraphs to creative reviews—while utilizing AI tools to analyze readability, optimize sentence structure, and generate content outlines.	L3 (Apply)
CO4	Construct professional workplace communications—including business emails, short reports, resumes, and digital profiles—while leveraging AI tools to refine tone, optimize for ATS filters, and streamline document structure.	L4 (Analyze)
CO5	Evaluate the role, benefits, and ethical implications of Artificial Intelligence in modern communication, using AI tools responsibility for language learning, cross-cultural translation, content creation, and e-portfolio development while adhering to academic integrity	L5,6 (Evaluate, Create)

3. Course Syllabus

UNIT I	Foundations of English Communication

Core Content:

Basics of Communication: process, types (verbal/non-verbal), and barriers. Parts of Speech: nouns, pronouns, verbs, adjectives, adverbs. Tenses: simple, continuous, perfect, and perfect continuous. Subject-verb agreement and correction of sentences.

AI Integration:

Grammar explanation, error identification, and instant Q&A on language rules, Real-time grammar,

spelling, and punctuation correction with detailed explanations, Phonetics practice – voice recording for pronunciation and intonation feedback, Word-of-the-day, etymology, and interactive vocabulary quizzes.

Free/Open-Source AI Tools:

Grammarly (free); ChatGPT / Gemini (free tiers); Google Speech-to-Text (free); Merriam-Webster Vocabulary Builder (free)

UNIT II Listening and Speaking Skills

Core Content:

Principles of Effective Speaking and Active Listening. Group Discussion (GD): techniques, etiquette, and evaluation criteria. Presentation Skills: design principles, slide preparation, and delivery techniques. Debate: argument construction, evidence use, and rebuttal techniques.

AI Integration:

AI-powered presentation design – structured, visual, professional slides, Fluency analysis, filler-word detection, pacing, and confidence scoring, Auto-transcription and keyword analysis of spoken communication, Visual communication design – infographics, posters, and slide aesthetics

Free/Open-Source AI Tools:

Gamma.app (free); Orai AI Speech Coach (free); Otter.ai (free tier); Canva AI (free)

UNIT III Reading Comprehension & Writing Skills

Core Content:

Reading Strategies: skimming, scanning, intensive and extensive reading. Comprehension passages, synonyms, antonyms, words often confused, homonyms, homophones, and homographs. Paragraph Writing: topic sentence, supporting details, clincher sentence. Creative Writing — features and techniques — movie reviews and blogs.

AI Integration:

AI paraphrasing tool – rewrite passages at varying complexity levels, Readability scoring, passive voice detection, and sentence simplification, Essay outline generation, argument structuring, and content brainstorming, Vocabulary simplification for improving comprehension of complex texts

Free/Open-Source AI Tools:

QuillBot (free); Hemingway Editor (free online); ChatGPT (free); Rewordify (free)

UNIT IV Professional & Business Communication

Core Content:

Email Writing and Letter Writing: formal and informal. Short Report Writing: structure, types (formal/informal), and format. Note-Making and Summarization Techniques. Resume / CV Writing and LinkedIn Profile Optimization.

AI Integration:

Draft and refine professional emails, cover letters, reports, and proposals, AI-powered resume builder with ATS-optimized templates, Report structuring, agenda writing, and knowledge management, Tone detection, formality check, and professional register evaluation

Free/Open-Source AI Tools:

ChatGPT (free); Kickresume (free tier); Grammarly (free); Notion AI (free tier)

UNIT V	Use of AI in Language Learning

Core Content:

Artificial Intelligence in Communication: meaning, basics, benefits and limitations of AI in human interaction. AI chatbots and virtual assistants in education: grammar correction, vocabulary building, AI-based speaking and pronunciation tools, writing assistants, e-portfolio creation. AI in Global Communication: automated translation, summarizing large texts, finding information in different languages. Digital Communication and AI Ethics: responsible use of AI in education, plagiarism and academic honesty, fake information and AI-generated content, privacy, bias, and ethical communication online.

AI Integration:

Plagiarism detection, paraphrase checker, and academic integrity analysis, High-accuracy translation supporting intercultural communication understanding, AI literacy modules – understanding AI bias, ethics, and responsible usage, E-portfolio creation platform for showcasing communication artifacts

Free/Open-Source AI Tools:

Copyleaks / Turnitin (institutional access); DeepL Translator (free); Wix (free); Adobe Portfolio (free for students); ChatGPT / Gemini (free tiers)

4. Books and Materials

Textbooks

1. Raman M. and Sharma S., Technical Communication: Principles and Practice, Oxford University Press, 4th Edition, 2022.
2. Shetty J. and Pareek R., Communicative English for Engineers and Professionals, Wiley India, 3rd Edition, 2021.

Reference Books

1. Rizvi M.A., Effective Technical Communication, Tata McGraw-Hill, 2nd Edition, 2018.
2. Murphy H.A., Effective Business Communication, McGraw-Hill Education, 7th Edition, 2019.
3. Wren P.C. and Martin H., High School English Grammar and Composition, S. Chand, Revised Edition, 2019.

Web Resources & NPTEL Links

- British Council – Learn English – https://learnenglish.britishcouncil.org
- NPTEL – Communication Skills – https://nptel.ac.in/courses/109104101
- Purdue OWL (Online Writing Lab) – https://owl.purdue.edu

BBC Learning English – https://www.bbc.co.uk/learningenglish

AI TOOLS AND APPLICATIONS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
1	0	4	0	14	0	56	0	3	30	70	100

1. Course Objectives

- Introduce students to AI concepts and the landscape of AI tools available for everyday academic and professional use.
- Develop practical skills in using AI for document creation, presentations, writing, and academic tasks applicable across all engineering disciplines.
- Build proficiency in AI-powered data analysis, spreadsheet automation, and intelligent research tools without requiring programming knowledge.
- Expose students to AI tools in visual design, media creation, and note-taking, and progressively to AI applications specific to their engineering branch.
- Cultivate responsible AI habits: verifying outputs, protecting privacy, respecting intellectual property, and understanding ethical and legal boundaries of AI use.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Explain what AI is, how it works conceptually, and describe the landscape of AI tools across text, image, audio, video, and code categories. (L2)	L3 (Apply)
CO2	Use AI tools to create documents and presentations; apply prompt engineering and NotebookLM to improve writing, research, and study habits. (L3)	L4 (Analyse)
CO3	Perform data analysis using AI without coding; use AI-powered research and note-taking tools to find, verify, organize, and summarize information. (L3)	L4 (Analyse)
CO4	Apply AI tools in visual design, diagrams, and media; identify and verify AI applications relevant to their own engineering discipline. (L4)	L5 (Evaluate)
CO5	Demonstrate responsible AI usage — bias, privacy, ethics, governance; design and present an AI-assisted mini-project using tools from all units. (L5)	L5 (Evaluate)

3. Course Syllabus

UNIT I: UNDERSTANDING AI AND AI FOR DOCUMENTS AND PRESENTATIONS

Core Content: What is AI: AI vs. ML vs. Deep Learning vs. Generative AI; brief history (Turing Test → ChatGPT → generative AI era); how LLMs work (training data, next-token prediction, temperature, hallucinations, context windows, knowledge cutoffs). AI ecosystem: ChatGPT, Claude, Gemini, Microsoft Copilot — strengths and differences.

AI for presentations: Gamma.app — full slide deck from a paragraph prompt; Microsoft Copilot in PowerPoint — slide generation, design suggestions, speaker notes; Canva AI — Magic Design, text-to-presentation, brand kits; Beautiful.ai — smart slide layouts; comparing AI-generated vs. manually created presentations.

AI for document writing: Microsoft Copilot in Word — draft, rewrite, summarize; Gemini in Google Docs — writing assistance and inline Q&A; Notion AI — meeting notes, project plans, knowledge base; Claude Projects — organizing documents and having a persistent AI assistant over a set of files.

AI writing assistance: Grammarly — grammar, tone, clarity, plagiarism; ChatGPT and Claude for lab reports, proposals, and letters; academic integrity — AI as an assistant not an author; disclosure norms; identifying AI-generated content using GPTZero.

AI Integration: Use Gamma.app to generate a presentation on an engineering topic in under 2 minutes; use Copilot in Word or Gemini in Docs to draft and improve a report; compare ChatGPT, Claude, Gemini, and Microsoft Copilot on the same writing task; use Grammarly to review your own writing.

UNIT II: AI FOR RESEARCH, NOTE-TAKING, DATA, AND SPREADSHEETS

Core Content: NotebookLM (Google): uploading lecture notes, textbooks, PDFs, and research papers as sources; asking questions grounded in uploaded documents; generating study guides, timelines, briefing documents, and audio overviews (podcast-style summaries) from sources; source-grounded answers that cite the exact passage — eliminating hallucination risk.

AI for research: Perplexity AI (real-time web search with citations), Gemini Deep Research (multi-step research reports), Elicit and Consensus (academic paper search with evidence summaries); verifying AI-generated citations on Google Scholar; why AI fabricates references and how to detect it.

Prompt engineering: zero-shot, one-shot, few-shot, chain-of-thought, role-based prompting; iterative refinement; negative prompting; building effective prompts for summarization, comparison, explanation, and data extraction; using ChatGPT custom instructions and Claude Projects for persistent context.

AI for spreadsheets and data analysis: Microsoft Copilot in Excel — VLOOKUP, IF, COUNTIF, pivot tables from natural language; Gemini in Google Sheets — formula generation and chart creation; ChatGPT Advanced Data Analysis and Julius AI — uploading CSV files, computing statistics, generating charts, interpreting patterns — no coding required.

AI Integration: Upload your own lecture notes to NotebookLM and generate a study guide and audio overview; use Perplexity AI and Gemini Deep Research to research a topic; verify citations on Google Scholar; use Wolfram Alpha or Symbolab to solve and verify equations from your current semester subjects; use Copilot in Excel or ChatGPT ADA to analyse a real dataset

UNIT III: AI FOR VISUAL DESIGN, DIAGRAMS, AND MEDIA

Core Content: AI for image generation: DALL-E 3 (via ChatGPT), Canva AI (text-to-image, Magic Design, background remover), Adobe Firefly, Ideogram — writing effective image prompts (style, subject, composition, colour); iterative prompt refinement for posters, diagrams, and mockups.

AI for diagrams and visual thinking: Napkin.ai — converting text or concepts into visual diagrams, charts, and infographics automatically; Whimsical AI — AI-generated mind maps, flowcharts, and wireframes from a description; Miro AI — collaborative whiteboard with AI summarization and diagramming.

AI for audio and video: ElevenLabs — text-to-speech and voice cloning for presentations and voiceovers; Suno and Udio — AI music generation for project videos; Runway and Pika — generating short video clips from text prompts; HeyGen — AI avatars for video presentations; current limitations and appropriate use cases.

AI content detection and critical evaluation: GPTZero, Originality.ai for AI-text detection; Google Lens and reverse image search for AI-generated images; fact-checking workflows — cross-referencing primary sources; deepfakes and synthetic media — recognition, risks, and responsible creation.

AI Integration: Use Napkin.ai to convert a paragraph of text into a diagram; use Whimsical AI to generate a mind map of a course topic; use DALL-E 3 or Canva AI to create an event poster through 3 prompt iterations; use ElevenLabs to create a voiceover; test GPTZero on 5 samples and analyse confidence scores.

UNIT IV: AI ACROSS ENGINEERING DISCIPLINES

Core Content: AI in Mechanical Engineering: generative design in CAD (Autodesk Fusion 360 — AI-optimized structures for weight and load); predictive maintenance using sensor data and ML; AI-assisted FEA simulation; manufacturing process optimization; digital twins.

AI in Civil and Electrical Engineering: structural health monitoring using ML; smart grid load forecasting and energy management; AI for circuit simulation and PCB layout optimization (Altium AI); VLSI design automation — floor planning and routing; power systems fault detection.

AI in Electronics and Communication: AI-assisted signal processing and filtering; speech recognition for embedded systems; computer vision for industrial quality inspection; AI in antenna design and spectrum management; MATLAB AI and Deep Learning Toolbox.

AI in Computer Science and allied branches: GitHub Copilot for code generation, explanation, and review; AI-powered testing (Testim, Selenium AI); AI in cybersecurity — anomaly detection and intrusion detection;

no-code/low-code platforms (Bubble, Glide, Webflow AI); AI for data science (Jupyter AI, DataRobot).

AI Integration: Each student identifies 5 real AI tools in their own engineering branch using Claude or ChatGPT and verifies each using official product pages or research publications; present findings in a 3-minute class presentation with a structured comparison table.

UNIT V: RESPONSIBLE AI, ETHICS, AND CAPSTONE PROJECT

Core Content: AI bias and fairness: sources of bias (data, model, deployment); real documented cases — Amazon hiring algorithm (2018), COMPAS recidivism (2016), facial recognition disparities (NIST 2019); fairness metrics; misinformation, deepfakes, and synthetic media risks.

Privacy and intellectual property: what happens to data entered into public AI tools; PII risks; data retention policies of ChatGPT (OpenAI), Claude (Anthropic), and Gemini (Google); who owns AI-generated content; copyright status globally; academic plagiarism with AI; personal data safety protocol.

AI governance frameworks: EU AI Act risk tiers (unacceptable, high, limited, minimal); UNESCO AI Ethics Recommendation; India's NITI Aayog Responsible AI Guidelines; India Digital Personal Data Protection Act 2023 (DPDP Act); environmental cost of AI — energy and carbon footprint of LLM training and inference.

Capstone Mini-Project: each student (or pair) defines a real engineering problem, selects at least 3 AI tool categories from Units I–IV, produces a quality-verified deliverable (report, presentation, diagram, or automation), and presents in 5 minutes. Evaluation: problem clarity, tool selection, output quality, human refinement, responsible AI disclosure.

AI Integration: Read and compare data retention policies of ChatGPT, Claude, and Gemini; classify 5 daily-use AI systems using EU AI Act risk tiers; use GPTZero and Google Lens to detect AI-generated content; design and present the Capstone Mini-Project integrating tools from all five units.

4. Books and Materials

LEARNING RESOURCES

Reference Books

1. Ethan Mollick, Co-Intelligence: Living and Working with AI, Portfolio/Penguin, 2024.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2020.
3. Reid Blackman, Ethical Machines, Harvard Business Review Press, 2022.
4. Google – Fundamentals of AI – grow.google/intl/en_in/ai-learning-resources
5. Microsoft – AI Skills Navigator – microsoft.com/en-us/ai/ai-skills
6. Andrew Ng – AI for Everyone (Coursera, free to audit) – coursera.org/learn/ai-for-everyone
7. Elements of AI – University of Helsinki (free, beginner) – elementsofai.com
8. AI Assistants: ChatGPT – chat.openai.com | Claude – claude.ai | Gemini – gemini.google.com | Microsoft Copilot – copilot.microsoft.com
9. Research & Notes: NotebookLM – notebooklm.google.com | Perplexity AI – perplexity.ai | Elicit – elicit.org | Consensus – consensus.app
10. Presentations & Docs: Gamma.app | Notion AI – notion.so | Beautiful.ai | Copilot in Office 365 | Gemini in Google Workspace
11. Diagrams & Design: Napkin.ai | Whimsical AI – whimsical.com | Miro AI – miro.com | Canva AI – canva.com | DALL-E 3 via ChatGPT
12. Data & Spreadsheets: ChatGPT Advanced Data Analysis | Julius AI – julius.ai | Copilot in Excel | Gemini in Sheets
13. Math & Equations: Wolfram Alpha – wolframalpha.com | Symbolab – symbolab.com | Mathway – mathway.com | Microsoft Math Solver – math.microsoft.com | Photomath – photomath.com | Desmos – desmos.com | GeoGebra – geogebra.org

14. Audio & Video: ElevenLabs – elevenlabs.io | Suno – suno.com | Runway – runwayml.com | HeyGen – heygen.com
15. Detection & Automation: GPTZero – gptzero.me | Originality.ai | Google Lens | Make.com | GitHub Copilot

Online Resources

- https://www.youtube.com/@JoyofLearningCSE/featured
- EU AI Act – eur-lex.europa.eu | UNESCO AI Ethics – unesco.org | NITI Aayog – niti.gov.in India DPDP Act 2023 – meity.gov.in | ProPublica COMPAS – propublica.org | MIT Technology Review – technologyreview.com |

PHYSICS FOR COMMUNICATION SYSTEMS LAB

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	3	0	0	0	42	1.5	30	70	100

1. Course Objectives

- Provide hands-on experimental verification of the physical principles underlying optics, electromagnetism, and semiconductor behaviour.
- Develop skill in the use of standard laboratory instruments for measuring optical, electrical, and magnetic quantities.
- Train students to record, analyse, and interpret experimental data with appropriate error estimation.
- Introduce AI/ML and Python-based computational tools for simulation and analysis of physics experiments.

Course Prerequisites: Physics for Communication Systems (Theory)

Course Outcomes (COs)

CO1: Determine the dispersive power of a prism, thickness by the wedge method, radius of curvature by Newton's rings, and wavelengths of the mercury spectrum and a LASER using a diffraction grating; record, tabulate, and interpret optical measurement data.

CO2: Estimate Planck's constant from photoelectric-effect data relating results to quantum concepts relevant to computing devices.

CO3: Trace B–H curves of magnetic materials, measure resistivity by the four-probe method, determine the energy gap of a semiconductor using a p–n junction diode and analyse and compare experimental values with theoretical/standard values.

CO4: Determine the temperature coefficient of a thermistor, and the magnetic field along a coil axis by Stewart & Gee's method; evaluate results against theoretical predictions.

CO5: Automate optical fringe analysis using OpenCV, extract Planck's constant by regression on photoelectric data, and perform dispersive-power curve fitting with Matplotlib/NumPy; evaluate computational-model accuracy using percentage error and R2

Course Content

PART A

List of Experiments

Any 10 of the following experiments

1. Determination of the thickness of a thin object by the wedge method.
2. Determination of the radius of curvature of the lens by Newton’s rings.
3. Determination of wavelengths of various colours of mercury spectrum using a diffraction grating in the normal incidence method.
4. Determination of the dispersive power of the prism.
5. Determination of wavelength of a LASER using a diffraction grating.
6. Determination of particle size using a diode laser

7. Estimation of Planck's constant using the photoelectric effect.
8. Determination of magnetic field along the axis of a current-carrying circular coil by Stewart & Gee's Method.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. Determination of the energy gap of a semiconductor using a p-n junction diode.
11. Determination of the resistivity of semiconductor by Four Probe Method
12. Determination of Numerical Aperture of an optical fiber.
13. Determination of bending loss in plastic optical fiber.
14. Determination of temperature co-efficient of a given material –Thermistor
15. Measurement of self-Inductance of a coil using LCR meterand Resonance Method

PART B

AI Integration Lab Exercises

Any two (2) of the following AI exercises must be completed using Python / Google Colab or an equivalent AI/LLM tool.

1. **Optics Data Automation (Python / Matplotlib):** input raw angle-of-deviation data from the prism experiment; fit a polynomial to the deviation-vs-angle curve; extract the angle of minimum deviation and compute the dispersive power; overlay the fitted curve on the experimental data points.

2. **Fringe Analysis using OpenCV (Python / Google Colab):** import Newton's-ring or wedge-fringe images; apply Gaussian blur and Canny edge detection to locate fringe centres; compute fringe diameters automatically; calculate radius of curvature or thickness and compare with manual measurements.

3. **Planck's Constant Estimation (Python / NumPy):** input stopping-potential vs. frequency data from the photoelectric experiment; apply linear regression (V0 vs. ν); extract the slope to compute h and the y-intercept to find the work function; plot the regression line and quantify percentage error against the accepted value 6.626 × 10−34 J·s.

AI Integration:

AI integration adds two to three exercises after the regular experiments: (i) Python automation of prism deviation curve-fitting and

dispersive-power extraction using Matplotlib/NumPy; (ii) OpenCV-based fringe-image analysis for Newton's rings and the wedge method, automating diameter measurement and

radius-of-curvature computation; (iii) linear regression on photoelectric-effect data to extract Planck's constant and the work function — reinforcing the connection between the physical experiment and quantum theory, and giving CSE students hands-on practice applying programming and data-analysis skills to experimental physics.

Textbooks

As prescribed by the department – refer to the corresponding Engineering Physics theory course textbooks and the laboratory manual issued by the Department of Physics.

Reference Books

As prescribed by the department – refer to the corresponding Engineering Physics theory course reference books and the laboratory manual issued by the Department of Physics.

Recommended Free & Open-Source AI/Computational Tools

- Python (NumPy, SciPy, OpenCV, Matplotlib) – FREE on Google Colab for wave optics and EM field analysis

- scikit-learn (free, open-source) – for semiconductor property prediction and EMI data analysis
- OpenEMS (free, open-source) – for 3D electromagnetic field simulation and power system analysis
- PhET Interactive Simulations (free) — wave optics, semiconductors, and quantum phenomena: phet.colorado.edu
- Virtual Labs — IIT (free): https://iitb.vlabs.co.in/discipline.html?discipline=Physical_Sciences —online simulation of optics, semiconductor, and EM experiments
- HyperPhysics (free) — concept reference for optics, quantum, and EM theory: hyperphysics.phy-astr.gsu.edu.

COMPUTATIONAL THINKING AND PROBLEM SOLVING WITH PYTHON LAB

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	0	0	0	0	42	1.5	30	70	100

1. Course Objectives

- Introduce students to computational thinking and problem-solving techniques.
- Develop the ability to design algorithms, flowcharts, and pseudocode.
- Provide foundational knowledge of Python programming — data types, operators, and I/O.
- Enable students to implement logic using control structures and data structures.
- Develop skills in modular programming, file handling, and basic OOP concepts.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Apply computational thinking concepts to design algorithms, flowcharts, and basic Python programs. (L3)	L3 (Apply)
CO2	Develop programs using decision-making and looping constructs to solve logical problems. (L3)	L3 (Apply)
CO3	Analyse and manipulate data using strings, lists, tuples, and sets for problem solving. (L4)	L4 (Analyse)
CO4	Design modular programs using functions, recursion, and dictionaries to improve code reusability. (L4)	L4 (Analyse)
CO5	Implement file handling, exception handling, and basic object-oriented programming concepts in Python applications. (L3)	L3 (Apply)

3. Course Syllabus

MODULE I: COMPUTATIONAL THINKING & PROGRAMMING BASICS

Topics: Computational thinking — decomposition and abstraction; algorithms, flowcharts, and pseudocode; Python environment setup; variables, data types, input/output, and operators; basic computational problems.

AI Integration: Generate alternate solutions and test inputs; verify flowchart correctness; compare solution efficiency; explain type conversion.

Suggested Tools: Python, Flowgorithm, draw.io AI, ChatGPT, Microsoft Copilot

Experiments:

- **Experiment 1: Problem Solving using Computational Thinking —** Select three daily-life problems; apply decomposition and abstraction; write algorithms, draw flowcharts, and convert them into pseudocode.
- **Experiment 2: Flowchart Design and Algorithm Simulation —** Design flowcharts for largest of three numbers, student grade calculation, and electricity-bill generation; simulate execution and verify outputs.
- **Experiment 3: Python Programming Fundamentals —** Install the Python environment; write programs using variables, data types, input/output, and operators; solve simple interest, area, and unit-conversion problems.

MODULE II: DECISION MAKING & LOOPING

Topics: Decision-control statements; looping and iterative problem solving; nested loops and pattern generation.

AI Integration: Generate boundary and test cases; verify decision logic; trace loop execution; compare loop alternatives; optimize nested loops.

Suggested Tools: Python, Python Tutor, ChatGPT, Microsoft Copilot

Experiments:

- **Experiment 4: Decision Control Statements —** Develop Python programs for largest among three numbers, grade calculation, leap-year checking, and a menu-driven calculator.
- **Experiment 5: Looping and Iterative Problem Solving —** Implement programs for prime-number generation, Armstrong numbers, factorial computation, and multiplication tables.
- **Experiment 6: Nested Loops and Pattern Generation —** Generate number, pyramid, diamond, and character patterns.

MODULE III: STRINGS & DATA STRUCTURES

Topics: String processing; lists and nested lists; tuples and sets.

AI Integration: Generate string test cases and sample datasets; explain slicing and immutable structures; compare list approaches and suggest optimizations.

Suggested Tools: Python, Python Tutor, Algorithm Visualizer, ChatGPT

Experiments:

- **Experiment 7: String Processing Applications —** Develop programs for string reversal, palindrome checking, frequency counting, and word-occurrence analysis.
- **Experiment 8: List and Nested List Operations —** Perform sorting, searching, list merging, and matrix operations using nested lists.
- **Experiment 9: Tuple and Set Applications —** Implement tuple packing/unpacking, student-record storage, and set union, intersection, and difference operations.

MODULE IV: FUNCTIONS & PROBLEM SOLVING

Topics: User-defined functions; recursion; dictionaries and lambda functions.

AI Integration: Generate function examples and datasets; verify outputs; generate recursion trees; compare iterative and recursive solutions; explain lambda execution.

Suggested Tools: Python, Python Tutor, Algorithm Visualizer, ChatGPT

Experiments:

- **Experiment 10: User-Defined Functions —** Implement positional, keyword, default, and variable-length arguments.
- **Experiment 11: Recursive Problem Solving —** Develop recursive solutions for factorial, Fibonacci, GCD, and Tower of Hanoi.
- **Experiment 12: Dictionary and Lambda Applications —** Implement a student database, dictionary operations, dictionary sorting, and lambda-based computations.

MODULE V: FILE HANDLING, EXCEPTION HANDLING & OOP

Topics: File processing and data storage; exception handling and testing; object-oriented programming — classes, objects, constructors, methods.

AI Integration: Generate datasets and error scenarios; verify file outputs; recommend exception strategies; generate class diagrams and suggest object interactions.

Suggested Tools: Python, ChatGPT, Microsoft Copilot

Experiments:

- **Experiment 13: File Processing and Data Storage —** Develop programs to create and read text files, count words, and process CSV data.
- **Experiment 14: Exception Handling and Testing —** Implement try-except, finally, and custom exceptions; apply exception handling to division operations, file access, and input validation.
- **Experiment 15: Object-Oriented Programming Mini Project —** Develop a Python application using classes, objects, constructors, and methods

4. Books and Materials

LEARNING RESOURCES

Textbooks

1. TB1: Pieter Spronck, Computational Thinking with Python, (course textbook — covers computational thinking, algorithms, and Python programming).
2. TB2: Reema Thareja, Programming in Python, Oxford University Press. (Primary implementation reference — all five units.)

Reference Books

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media. (Free at greenteapress.com)
2. Eric Matthes, Python Crash Course, 2nd Edition, No Starch Press.

Online Resources

- Algorithm & Flowchart: Flowgorithm – flowgorithm.org | Lucidchart – lucidchart.com | Algorithm Visualizer – algorithm-visualizer.org
- Programming & Debugging: Python Tutor – pythontutor.com | Thonny – thonny.org | Replit – replit.com
- Data & Scientific: Pandas – pandas.pydata.org | NumPy – numpy.org | SymPy – sympy.org
- NLP & Text: NLTK – nltk.org | TextBlob – textblob.readthedocs.io
- Development: Jupyter Notebook – jupyter.org | PyCharm – jetbrains.com/pycharm | OpenPyXL – openpyxl.readthedocs.io
- NPTEL – Problem Solving through Programming in C / Python – nptel.ac.in

COMMUNICATIVE ENGLISH LAB

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	2	0	0	0	28	1	30	70	100

1. Course Objectives

- Build strong oral communication abilities through targeted speaking and listening activities.
- Refine pronunciation, tone, and spoken fluency using AI-driven voice tools.
- Develop key career-ready skills in group discussions, debates, and public speaking.
- Train students to produce high-quality workplace documents, including emails, formal reports, and cover letters.
- Utilize AI technology for self-evaluation, real-time feedback, and ongoing skill development.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	BTL
CO1	To speak English with proper pronunciation using phonetic standards while displaying smooth, natural vocal fluency.	Apply
CO2	To demonstrate strong listening comprehension in English and communicate appropriately across various social and professional settings.	Understand
CO3	To present well-reasoned arguments confidently during group discussions, debates, and formal presentations.	Analyse
CO4	To compose well-structured, error-free professional documents—including emails, reports, and resumes—tailored to specific audience needs.	Create
CO5	To apply AI-driven tools to support language learning, assess personal progress, and continuously refine English skills.	Evaluate

3. Course Syllabus

S.No	Lab Topic	Lab Activities	AI Activity	AI Tools	COs
1	**Phonetics & Pronunciation Practice**	Record & playback vowel/consonant articulation; IPA chart drill; Minimal pair exercises	Use AI speech-to-text to detect mispronunciations; real-time phoneme feedback via ELSA Speak	ELSA Speak, Google Speech Recognition, Speechling	**CO1, CO5**
2	**Listening Comprehension &Note-Taking**	Listen to TED Talks/podcasts; fill-in-the-blank exercises; summarise audio passages	Auto-generate transcripts; compare student notes with AI-generated summaries using Otter.ai	Otter.ai, YouTube Auto-captions, Whisper AI	**CO2, CO5**
3	**Spoken**	Impromptu speaking (1–2	AI analyses speech for	Speeko,	**CO1,**

	English & Fluency Building	min); picture description; story completion tasks	filler words, pace, and clarity; ChatGPT prompts for spontaneous speaking	ChatGPT, Google Assistant	**CO3, CO5**
4	**Group Discussion Techniques**	Role-based GD on current topics; turn-taking practice; consensus building	AI evaluates argument structure and language; ChatGPT generates counter-arguments for practice	ChatGPT, Gemini, Mentimeter	**CO2, CO3**
5	**Public Speaking & Presentations**	Prepare and deliver 3-minute presentations; use of visual aids; Q&A handling	AI slide deck generation; real-time delivery feedback on pacing and confidence	Beautiful.ai, Gamma.app, Microsoft Copilot	**CO3, CO5**
6	**Interview Skills & Mock Interviews**	HR round simulation; STAR method answers; body language and eye contact	AI-powered mock interview with instant feedback on content, grammar, and tone	Yoodli, Interview Warmup by Google, ChatGPT	**CO1, CO3, CO5**
7	**Professional Email & Business Writing**	Draft formal emails, complaints, and requests; subject line formulation; netiquette	AI refines email drafts; tone & clarity check; compare student draft with AI-improved version	Grammarly, ChatGPT, Gemini	**CO4, CO5**
8	**Resume & Cover Letter Writing**	ATS-friendly resume design; action verbs usage; tailoring cover letters to job descriptions	AI resume scanner; keyword optimisation suggestions; ChatGPT cover letter generation and critique	Kickresume, Resume.io, Jobscan, ChatGPT	**CO4, CO5**
9	**Reading Comprehension & Critical Thinking**	Read articles/editorials; identify main idea, inference, and tone; speed reading drills	AI generates comprehension questions; text summarisation and comparative analysis	Quillbot, Speechify, NotebookLM	**CO2, CO4**
10	**Debate & Argumentation Skills**	Structured debate (for/against); Rebuttal techniques; logical fallacy identification	AI generates arguments on both sides; evaluate logical structure using ChatGPT	ChatGPT, Claude.ai, Kialo Edu	**CO2, CO3**
11	**Report Writing & Technical**	Lab report, incident report, and project report formats; headings, data	AI improves report coherence and passive/active voice	Grammarly Business, ChatGPT,	**CO4, CO5**

	Communication	presentation	usage; grammar and structure feedback	Hemingway Editor	
12	**Etiquette, Netiquette & Personal Branding**	Workplace conversation role play; LinkedIn profile creation; professional social media etiquette	AI reviews LinkedIn summaries; digital persona analysis; personal brand statement via ChatGPT	ChatGPT, Canva AI, LinkedIn AI features	**CO3, CO4, CO5**

4. Books and Materials

S.No	Reference
1	Raman, Meenakshi & Sharma, Sangeeta. Technical Communication: Principles and Practice (3rd Ed.). Oxford University Press, 2022.
2	Krishnaswamy, N. & Krishnaswamy, L. The Story of English in India. Foundation Books, Cambridge University Press, 2021.
3	Swan, Michael. Practical English Usage (4th Ed.). Oxford University Press, 2016.
4	Murphy, Raymond. English Grammar in Use (5th Ed.). Cambridge University Press, 2019.
5	Rizvi, M. Ashraf. Effective Technical Communication (2nd Ed.). McGraw-Hill Education, 2018.
6	Turton, N.D. & Heaton, J.B. Longman Dictionary of Common Errors. Pearson Longman, 2017.
7	Lesikar, Raymond V. & Flatley, Marie E. Basic Business Communication (12th Ed.). McGraw-Hill, 2020.
8	Rutherford, Andrea J. Basic Communication Skills for Technology (3rd Ed.). Pearson, 2019.

Learning material:

- BBC Learning English – https://www.bbc.co.uk/learningenglish (Grammar, pronunciation, and listening)
- British Council Learn English – https://learnenglish.britishcouncil.org
- TED Talks – https://www.ted.com/talks (Listening & speaking practice)
- Coursera English Communication Skills Specialisation – https://www.coursera.org
- edX English for Professional and Academic Purposes – https://www.edx.org
- Grammarly Blog – https://www.grammarly.com/blog (Writing tips)
- ELSA Speak (App) – https://elsaspeak.com (AI pronunciation coach)
- English with Lucy – @EnglishwithLucy (Vocabulary, speaking, British accent)
- Learn English with TV Series – @LearnEnglishWithTVSeries
- Rachel's English – @rachelsenglish (American accent and pronunciation)
- TED-Ed – @TEDEd (Critical thinking and communication ideas)
- Spoken English Hub – @SpokenEnglishHub (Indian context, interview prep)
- JenniferESL – @JenniferESL (Grammar and business English)

Course Name	Platform	Provider	Link
Developing Soft Skills and Personality	NPTEL / SWAYAM	IIT Kanpur	https://swayam.gov.in
Business English Communication Suite	Coursera (Free Audit)	University of Washington	https://coursera.org
Speak English Professionally: In Person, Online & On the Phone	Coursera	Georgia Tech	https://coursera.org
English and Academic Preparation	NPTEL	IIT Bombay	https://nptel.ac.in
Technical English for Engineers	NPTEL / SWAYAM	IIT Roorkee	https://swayam.gov.in

Software / Tool	Type	Purpose
Grammarly	AI Writing Assistant	Grammar, punctuation, style correction
ChatGPT / Claude.ai	Generative AI Chatbot	Conversation practice, writing assistance, debate prep
Otter.ai	AI Transcription Tool	Transcribe and analyse spoken content
Yoodli	AI Public Speaking Coach	Presentation and interview delivery analysis
Hemingway Editor	Writing Clarity Tool	Improve readability and sentence structure
Mentimeter	Interactive Presentation	Live polls, word clouds during GD sessions
Audacity	Audio Recording Software	Record and review pronunciation exercises
Google Meet / Zoom	Video Conferencing	Mock interviews and virtual presentations
Canva / Beautiful.ai	AI Presentation Design	Create professional visual presentations

HEALTH AND WELLNESS, YOGA AND SPORTS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	1	0	0	0	14	0.5	-	100	100

1. Course Objectives

- Create awareness about holistic health, wellness, and preventive healthcare among students.
- Train students in yogic practices (asanas, pranayama, meditation) for physical and mental well-being.
- Enable students to design evidence-based personal fitness and nutrition plans.
- Develop sportsmanship, team spirit, fair play, and physical fitness through indoor and outdoor sports.
- Integrate technology and AI tools for health monitoring, performance analysis, and wellness management.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Explain the fundamental concepts of health, wellness, fitness, and the dimensions of holistic well-being.	L1 (Remember) L2 (Understand)
CO2	Demonstrate correct yogic practices — asanas, pranayama, and meditation — for physical and mental health.	L3 (Apply)
CO3	Design a personal fitness plan integrating nutrition, exercise, stress management, and lifestyle modification.	L3 (Apply) L4 (Analyze)
CO4	Understand rules, skills, and safety norms for a chosen sport and participate actively with sportsmanship.	L3 (Apply)
CO5	Evaluate personal health indicators and reflect on lifestyle choices using technology and evidence-based practices.	L5 (Evaluate)

3. Course Syllabus

UNIT I	Health, Wellness and Preventive Healthcare

Core Content:

Concept of health, wellness and fitness — definitions and seven dimensions. WHO definition of health; holistic health model (Physical, Mental, Social, Spiritual). Nutrition basics — macronutrients, micronutrients, balanced diet, BMI calculation. Lifestyle diseases — diabetes, hypertension, obesity — causes and prevention. Mental health and stress management — causes, symptoms, COPE model. Sleep hygiene and circadian rhythm regulation. Substance abuse — awareness, prevention, and rehabilitation. Personal hygiene, sanitation, and communicable disease prevention. Ergonomics and occupational health for students.

AI Integration:

Log BMI, steps and sleep for 2 weeks using Google Fit / Apple Health; generate AI health-insight reports and compare with WHO benchmarks.Use NutriAI / Eat Right Now app to design a 7-day balanced meal plan; compare output with ICMR dietary guidelines.

Free/Open-Source AI Tools:

Google Fit / Apple Health (free); Python (Pandas, Matplotlib) on Google Colab (free); ChatGPT / Gemini (free tiers); MyFitnessPal (free)

UNIT II	Yoga, Pranayama, Meditation and Mind-Body Practice

Core Content:

Introduction to Yoga — history, philosophy, Patanjali's Ashtanga Yoga. Surya Namaskar — 12-step sequence with correct breathing. Asanas for flexibility: Tadasana, Trikonasana, Paschimottanasana, Sarvangasana. Asanas for strength and balance: Virabhadrasana I and II, Vrikshasana, Naukasana. Pranayama techniques: Anulom-Vilom, Bhastrika, Kapalbhati, Bhramari. Meditation and mindfulness — Dharana, Dhyana, body-scan, guided relaxation. Yoga Nidra for sleep and stress relief. Yoga for specific conditions — stress, back pain, PCOD/PCOS, anxiety.

AI Integration:

Use YogaNotch / KAIA Health app for real-time AI posture feedback; record before/after improvement videos.

Free/Open-Source AI Tools:

YogaNotch / KAIA Health (free tier); ChatGPT / Gemini (free tiers); Python (Pandas, Matplotlib) on Google Colab (free); Insight Timer (free guided meditation app)

UNIT III	Physical Fitness, Sports Skills and Sports Technology

Core Content:

Physical fitness components — strength, endurance, flexibility, agility, speed, coordination. Principles of training — overload, progression, specificity, reversibility, individuality. Warm-up, cool-down, and dynamic stretching routines. Indoor sports: Badminton, Table Tennis, Chess, Carrom — rules and basic skills. Outdoor sports: Cricket, Football, Volleyball, Kabaddi, Athletics — rules and skills. Sports injuries — types, RICE method, prevention and return-to-play protocol. Sports psychology — motivation, goal setting, concentration and visualisation. Sports technology — wearables, fitness trackers, GPS analytics, performance dashboards.

AI Integration:

Engage with Woebot / Wysa AI mental-health chatbot for one week; write a critical reflection on AI vs human counsellor effectiveness.Analyse a cricket/football dataset on Google Colab using Pandas; visualise player performance KPIs with Matplotlib / Seaborn.

Free/Open-Source AI Tools:

Python (Pandas, Matplotlib, Seaborn) on Google Colab (free); ChatGPT / Gemini (free tiers); Google Fit / Apple Health (free)

4. Books and Materials

Reference Books:

1. Mangal S.K. and Mangal S., Health and Physical Education, PHI Learning Pvt. Ltd., 2021.
2. Broad W.J., The Science of Yoga, Simon & Schuster, 2012.
3. Silva, Mira and Mehta S., Yoga: The Iyengar Way, Dorling Kindersley, 2019.
4. Clover J., Sports Medicine Essentials, Cengage Learning, 2020.
5. Bucher C.A., Foundations of Physical Education and Sport, McGraw-Hill Education, 2018.

Online Resource:

- Ministry of AYUSH – https://main.ayush.gov.in
- National Health Portal – https://nhp.gov.in
- ICMR Dietary Guidelines – https://www.icmr.nic.in
- WHO Physical Activity Guidelines – https://www.who.int
- Khelo India Programme – https://kheloindia.gov.in

CYBER SECURITY AWARENESS FOR ENGINEERS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
2	0	0	0	24	0	0	0	0	100*	-	100*

1. Course Objectives

- Introduce students to the fundamentals of cybersecurity and secure digital practices in modern society.
- Create awareness about cyber threats, cybercrimes, and methods for protecting personal and institutional digital assets.
- Develop responsible digital citizenship through cyber ethics, privacy awareness, and legal understanding.
- Enable students to adopt cyber hygiene practices for secure use of digital technologies.
- Familiarise students with emerging cybersecurity concerns in cloud, digital platforms, and AI-enabled environments.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Explain fundamental cybersecurity concepts and their importance in digital environments.	L2 (Understand)
CO2	Identify common cyber threats, cyberattacks, and social engineering techniques.	L2 (Understand) L3 (Apply)
CO3	Apply safe practices for secure use of devices, networks, email, cloud services, and online platforms.	L3 (Apply)
CO4	Demonstrate awareness of cyber ethics, privacy protection, and cyber laws.	L2 (Understand)
CO5	Develop cyber hygiene habits and respond appropriately to common cybersecurity incidents.	L3 (Apply)

3. Course Syllabus

UNIT I	Introduction to Cyberspace and Cybersecurity

Core Content:

Introduction to cyberspace and cybersecurity — evolution of information systems and the Internet. Importance of cybersecurity in engineering and society. Information security concepts — CIA Triad (Confidentiality, Integrity, Availability). Digital footprint and digital identity. Security governance basics. Cyber threat actors. Engineering ethics and responsible digital behaviour. Cyber hygiene practices.

AI Integration:

Use AI/LLM tools to explain the CIA Triad using IoT-based engineering examples, helping students map safeguards to threats. Use AI to analyse their own digital footprint and compare personal data exposure across platforms.

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); CERT-In awareness materials (free); National Cyber Security Awareness Portal India (free)

UNIT II — Cyber Threats, Cybercrime and Social Engineering

Core Content:

Cyber threats and vulnerabilities. Cybercrime and cyber offenders. Malware: virus, worm, trojan, spyware, ransomware. Cyberattack lifecycle and common attack methods. Phishing, spear phishing, smishing and vishing. Social engineering attacks. Password attacks and credential theft. Identity theft and financial fraud. Insider threats. AI-enabled cyber threats and deepfakes. Case studies of major cyber incidents.

AI Integration:

Use AI/LLM tools to explain the cyberattack lifecycle using a ransomware case study, with students mapping attacker actions to preventive controls. Analyse a sample spear-phishing email (for awareness only) to identify social engineering tactics.

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); OWASP Top 10 (free public resource); Cisco Networking Academy (free)

UNIT III — Personal Cyber Safety and Cybersecurity Technologies

Core Content:

Password management and Multi-Factor Authentication. Authentication and access control concepts. Safe browsing practices. Email and communication security. Mobile device security. Cloud security basics. Secure use of Wi-Fi and public networks. Data backup and recovery. Cryptography and digital signatures (awareness level). Safe use of AI tools and digital platforms.

AI Integration:

Use AI/LLM tools to explain MFA mechanisms (OTP, authenticator apps, hardware keys), and students set up Google Authenticator to understand TOTP conceptually. Use AI tools to understand public Wi-Fi risks and build a personal safe browsing checklist.

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); Google Authenticator (free); Have I Been Pwned (free breach checker — https://haveibeenpwned.com)

UNIT IV — Privacy, Cyber Ethics and Cyber Laws

Core Content:

Data protection and privacy concepts. Personal data and sensitive information. Cyber ethics and responsible digital behaviour. Overview of cyber laws in India — Information Technology (IT) Act and related provisions (awareness level). Common cybercrimes and legal implications. Cybercrime reporting mechanisms and grievance redressal. Digital evidence basics. Social media responsibility and legal considerations.

AI Integration:

Use AI/LLM tools to explain key provisions of the IT Act 2000 and DPDP Act 2023, with students comparing data principal rights against GDPR. Use AI tools to understand the National Cyber Crime Reporting Portal and walk through a hypothetical complaint filing.

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); cybercrime.gov.in (free); MeitY DPDP Act resources (free)

UNIT V	Cyber Hygiene and Secure Digital Practices

Core Content:

Cybersecurity risk awareness. Password management and Multi-Factor Authentication (consolidation). Secure use of email, web, cloud, and public networks. Safe digital transactions and digital payment awareness. Secure use of social media and AI tools. Cybersecurity awareness in IoT and emerging technologies. Incident awareness and cyber hygiene best practices.

AI Integration:

Use AI/LLM tools to guide students through a personal cyber hygiene audit covering password strength, MFA, and privacy settings, identifying key improvements. Build a personal Cyber Hygiene Action Plan with AI assistance and peer-review it using a structured rubric.

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); NIST Cybersecurity Framework resources (free); CERT-In advisories (free); Cisco Networking Academy (free)

4. Books and Materials

1. Singh A., Introduction to Cyber Security, Universities Press / Orient BlackSwan, Latest Edition.
2. Godbole N. and Belapure S., Cyber Security: Understanding Cyber Crimes, Wiley India.
3. Brooks C.J. et al., Cybersecurity Essentials, Wiley.
4. Stallings W. and Brown L., Computer Security: Principles and Practice, Pearson.
5. Whitman M.E. and Mattord H.J., Principles of Information Security, Cengage Learning.

Online Resources

- CERT-In (Indian CERT) – https://www.cert-in.org.in
- National Cyber Crime Reporting Portal – https://cybercrime.gov.in
- NIST Cybersecurity Framework – https://www.nist.gov/cyberframework
- OWASP Foundation – https://owasp.org

II SEMESTER (I YEAR)										
Cours Code	Title of the Course	Category	Periods perWeek				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT201	Differential Equations & Vector Calculus	BS	3	0	2	0	4	30	70	100
26CHE207	Engineering Chemistry for Electronics and Communication Systems	BS	3	0	0	0	3	30	70	100
26MEC101	Engineering Graphics	ES	1	0	4	0	3	30	70	100
26EEE203	Network Analysis	PC	3	0	0	0	3	30	70	100
26HSM101	Design Thinking	HM	1	0	4	0	3	30	70	100
26ECE201	Electronics and Electrical Engineering Workshop	PC	0	0	0	2	1	30	70	100
26MEC102	Engineering Workshop	ES	0	0	0	3	1.5	30	70	100
26CHE208	Engineering Chemistry for Electronics and Communication Systems Lab	BS	0	0	0	3	1.5	30	70	100
26HSM102	NSS/NCC/Scouts & Guides/ Community Service	HM	0	0	0	1	0.5	30	70	100
		TOTAL	11	0	10	09	20.5	270	630	900

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	2	0	42	0	28	0	4	30	70	100

1. Course Objectives

- Develop analytical and computational competence in solving ordinary and partial differential equations arising in engineering systems.
- Enable students to interpret vector differential and integral operators in physical and engineering contexts.
- Integrate mathematical modeling, visualization, and simulation using modern AI-assisted computational tools in alignment with NEP 2020 and outcome-based education.
- Apply ODE and PDE solution methods to model real-world engineering phenomena such as circuits, vibrations, heat transfer, and fluid flow.
- Use computational tools for solving, verifying, and visualizing differential equations and vector field problems.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Apply analytical techniques and computational tools to solve first-order differential equations and simulate real-world engineering systems.	L3 (Apply)
CO2	Analyze higher-order linear ODEs and interpret solutions in dynamic engineering systems such as circuits and oscillators.	L4 (Analyze)
CO3	Formulate and solve first-order and selected higher-order PDEs relevant to engineering models including wave, heat, and Laplace equations.	L3 (Apply)
CO4	Interpret and compute gradient, divergence, and curl of scalar and vector fields and explain their physical significance in engineering contexts.	L4 (Analyze)
CO5	Apply Green's, Stokes', and Divergence theorems to compute work, circulation, and flux and evaluate engineering field behaviour.	L5 (Evaluate)

3. Course Syllabus

UNIT I: First-Order Ordinary Differential Equations

Core Content: Classification of ODEs by order, degree, and linearity; linear first-order ODEs and integrating factor method; Bernoulli's equation; exact equations and integrating factors; orthogonal trajectories; engineering applications of first-order ODEs:Newton's law of cooling and natural growth/decay models; electrical circuit models (RC and RL circuits).

AI Integration: Python SymPy dsolve for symbolic ODE solution and verification; direction field (slope field) visualization using Matplotlib; AI-assisted debugging of integrating factor derivations; using ChatGPT/Copilot to explain solution families and physical interpretations; SciPy solve_ivp for numerical ODE solution with initial conditions.

Free/Open-Source AI Tools: Python (SymPy, SciPy, Matplotlib) on Google Colab; Jupyter Notebook; Wolfram Alpha free tier for solution verification; GNU Octave for ODE routines.

UNIT II: Higher-Order Linear Differential Equations

Core Content: Superposition principle; Wronskian and linear independence; complementary function for constant-coefficient ODEs (distinct real, repeated, and complex roots); particular integral by operator method; variation of parameters; simultaneous linear ODEs; Cauchy's (Euler) equation; Legendre's equation; applications to LCR circuits, simple harmonic motion, damped and forced oscillations; mass-spring-dashpot systems.

AI Integration: Python SciPy signal.lsim for simulation of underdamped, critically damped, and overdamped responses; resonance amplitude curve generation; AI-assisted Wronskian computation and verification using SymPy; using AI tools to explain transient vs. steady-state response, resonance and Q-factor interpretation.

Free/Open-Source AI Tools: Python (NumPy, SciPy, SymPy, Matplotlib) on Google Colab; Jupyter Notebook; GNU Octave / MATLAB (optional) for LCR and mechanical system simulation; WolframAlpha free tier.

UNIT III: Partial Differential Equations

Core Content: Introduction and classification of PDEs; formation by elimination of arbitrary constants; formation by elimination of arbitrary functions; first-order linear PDEs and Lagrange's method (auxiliary equations); homogeneous linear PDEs with constant coefficients (CF and PI); second-order PDE applications — wave equation, heat equation, and Laplace's equation.

AI Integration: Python SymPy for PDE formation and symbolic verification; 3D surface plot visualization of PDE solution families using Matplotlib; SciPy finite-difference simulation of the 1D heat equation with animation; AI-assisted PDE classification using the discriminant; prompting AI to classify mixed-derivative PDEs and student verification of AI reasoning.

Free/Open-Source AI Tools: Python (SymPy, NumPy, SciPy, Matplotlib) on Google Colab; Jupyter Notebook; WolframAlpha free tier for PDE classification verification; Scilab.

UNIT IV: Vector Differentiation

Core Content: Scalar and vector fields; del (∇) operator; gradient and directional derivative; unit normal to surfaces; angle between surfaces; divergence and physical interpretation; curl and physical interpretation; vector identities; conservative fields and scalar potentials; Laplacian.

AI Integration: Python NumPy and Matplotlib for 2D and 3D gradient, divergence, and curl field visualization (quiver plots, level-surface overlays); SymPy for symbolic verification of vector identities; using AI tools to interpret Maxwell's equations in terms of divergence and curl operators; AI-assisted explanation of irrotational and solenoidal field classification.

Free/Open-Source AI Tools: Python (NumPy, SymPy, Matplotlib, mpl_toolkits) on Google Colab; Jupyter Notebook; SciPy for numerical gradient computation; GNU Octave.

UNIT V: Vector Integration and Integral Theorems

Core Content: Line integrals over scalar and vector fields; work done and path independence; surface integrals and flux; Green's theorem in the plane and its applications; Stokes' theorem; Divergence theorem (Gauss's theorem).

AI Integration: Python SciPy integrate for numerical computation of line and surface integrals; 3D flux visualization with colour-coded normal flux using Matplotlib; numerical verification of Green's and Stokes' theorems; AI-assisted physical interpretation of the Divergence theorem in terms of source density; prompting AI to explain connections to Gauss's law and student evaluation of AI explanations.

Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib) on Google Colab; Jupyter Notebook; SymPy for symbolic integral verification; WolframAlpha free tier; 3D plotting tools.

4. Books and Materials

Textbooks

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
3. G. B. Thomas, M. D. Weir, J. Hass, Thomas' Calculus, 14th Edition, Pearson, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5th Edition, Alpha Science International, 2021.

Reference Books

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 6th Edition, Jones & Bartlett, 2018.
2. George B. Arfken, Hans J. Weber, Frank E. Harris, Mathematical Methods for Physicists, 7th Edition, Academic Press, 2012.
3. Ian N. Sneddon, Elements of Partial Differential Equations, Dover Publications, 2006.
4. H. F. Davis and A. D. Snider, Introduction to Vector Analysis, 7th Edition, Hawkes Publishing, 1995.

Web Resources & NPTEL Links

1. NPTEL: Ordinary Differential Equations and Applications – https://nptel.ac.in
2. NPTEL: Partial Differential Equations – https://nptel.ac.in
3. NPTEL: Vector Calculus – https://nptel.ac.in
4. MIT OpenCourseWare – Differential Equations (18.03): https://ocw.mit.edu
5. MIT OpenCourseWare – Multivariable Calculus (18.02): https://ocw.mit.edu
6. Python SymPy Documentation: https://docs.sympy.org
7. SciPy Documentation: https://docs.scipy.org
8. Google Colab for Python: https://colab.research.google.com
9. NumPy Documentation: https://numpy.org/doc

Recommended Free & Open-Source AI/Computational Tools

1. Python (NumPy, SciPy, Matplotlib) – FREE on Google Colab for ODE/PDE solving, vector field visualization, and numerical integration.
2. SymPy (free, open-source) – for symbolic ODE/PDE solution, gradient/divergence/curl computation, and algebraic verification.
3. Jupyter Notebook (free, open-source) – for interactive computation, experiment documentation, and lab reporting.
4. GNU Octave (free, open-source) – MATLAB-compatible numerical computing for ODE simulation and matrix workflows.
5. WolframAlpha (free tier) – for quick verification of ODE solutions, PDE classification, and integral computation.
6. Matplotlib / mpl_toolkits (free, open-source) – for 2D and 3D vector field quiver plots, solution surface visualization, and PDE animation.
7. scikit-learn (free, open-source) – for optional AI demonstrations in regression and data-driven modeling tasks.

ENGINEERING CHEMISTRY FOR ELECTRONICS AND COMMUNICATION SYSTEMS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	0	0	42	0	0	0	3	30	70	100

1. Course Objectives

- Understand quantum chemistry concepts relevant to electronic systems.
- Study spectroscopy techniques used in material and signal analysis.
- Analyse semiconductor and electronic material chemistry.
- Explore electrochemical energy storage for communication systems.
- Apply AI/ML tools for materials analysis, device reliability, and energy optimization.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Apply quantum chemistry principles to analyse electronic systems and predict molecular orbital properties.	L3 (Apply) L4 (Analyze)
CO2	Analyse spectroscopic techniques for material characterization and interpret spectral data for molecular identification.	L3 (Apply) L4 (Analyze)
CO3	Evaluate semiconductor materials and chemical fabrication processes relevant to electronic device manufacturing.	L3 (Apply) L4 (Analyze)
CO4	Analyse energy storage systems and electrochemical principles for communication device power management.	L3 (Apply) L4 (Analyze)
CO5	Design corrosion prevention and reliability strategies for electronic components using AI-assisted analysis.	L5 (Evaluate) L6 (Create)

3. Course Syllabus

urse ContentUNIT I	Quantum Chemistry

Core Content:

Fundamentals of quantum chemistry — black body radiation, photoelectric effect, wave-particle duality, de-Broglie wave equation, Heisenberg's uncertainty principle. Fundamentals of quantum mechanics, Schrödinger wave equation, significance of Ψ and Ψ^2. Quantum numbers. Particle in a one-dimensional box. Molecular orbital theory — bonding in homo and hetero nuclear diatomic molecules — energy level diagrams of O_2 and CO. π-molecular orbitals of butadiene and benzene, calculation of bond order.

AI Integration:

Simulation of quantum systems using Python. Visualization of molecular orbitals and energy levels. Introduction to quantum computing models.

Free/Open-Source AI Tools:

Python (NumPy, SciPy), Google Colab

UNIT II	Spectroscopy

Core Content:

Introduction, types of energy in molecules, types of spectra, representation and general features of absorption spectra. Microwave spectroscopy — introduction, principle, instrumentation and

applications. UV-Visible spectroscopy — chromophore, auxochrome, bathochromic shift, hypsochromic shift, Beer-Lambert law, principle, instrumentation and applications. Infrared (IR) spectroscopy — introduction, principle, instrumentation and applications.

AI Integration:

AI-based spectral analysis and pattern recognition. Automated identification of compounds using machine learning models.

Free/Open-Source AI Tools: Python (Pandas, scikit-learn), spectroscopy datasets, Google Colab

UNIT III Chemistry of Electronic Materials

Core Content:

Atomic structure and chemical bonding relevant to semiconductors. Band theory: valence band, conduction band, band gap energy. Intrinsic and extrinsic semiconductors: silicon, germanium, gallium arsenide. Doping chemistry: n-type (phosphorus, arsenic) and p-type (boron, aluminum) dopants. Chemical vapor deposition (CVD) for thin film formation. Silicon dioxide (SiO_2) formation and properties. Chemistry of compound semiconductors: GaAs, InP, SiC.

AI Integration:

AI-based prediction of semiconductor properties and fabrication optimization. Data-driven defect analysis in semiconductor wafers.

Free/Open-Source AI Tools:

TensorFlow, Python, Scilab

UNIT IV Electrochemistry and Energy Storage

Core Content:

Fundamentals of electrochemistry: redox reactions, electrode potential, Nernst equation. Galvanic cells and electrolytic cells. Energy storage: batteries — primary batteries (zinc-air, sodium-air), secondary batteries (lead-acid, NiCd, NiMH), lithium-ion batteries ($LiFePO_4$). Supercapacitors: EDLC, pseudo capacitors for energy harvesting. Fuel cells: PEMFC, DMFC for backup power. Energy harvesting: solar cells (dye-sensitized, perovskite), thermoelectric generators. Battery management: charging algorithms, state of charge, thermal management.

AI Integration:

AI models for battery health monitoring and energy optimization in IoT devices. Predictive analytics for battery life and performance.

Free/Open-Source AI Tools:

Python (Pandas, scikit-learn), Google Colab

UNIT V Corrosion Chemistry and Protection

Core Content:

Corrosion: definition, types — chemical corrosion and electrochemical corrosion, Pilling-Bedworth rule. Galvanic corrosion. Factors affecting corrosion. Corrosion of printed circuit boards: copper oxidation, tin whiskers. Corrosion in solder joints and interconnects. Protective techniques: proper design, pure metal, metal alloys, inhibitors. Cathodic protection. Electroplating (nickel) and electroless plating (copper).

AI Integration:

Computer vision for PCB defect detection. AI-based prediction of corrosion failure in electronic components.

Free/Open-Source AI Tools:

OpenCV, TensorFlow, Python

4. Books and Materials

Textbooks

1. Jain P.C. and Jain M., Engineering Chemistry, 17th Edition, Dhanpat Rai Publishing Company, 2020.
2. Agarwal S., Engineering Chemistry, 5th Edition, Cambridge University Press, 2026.

Reference Books

1. Streetman B.G. and Banerjee S.K., Solid State Electronic Devices, 7th Edition, Pearson Education, 2015.
2. Sze S.M. and Ng K.K., Physics of Semiconductor Devices, 3rd Edition, John Wiley & Sons, 2006.
3. Dara S.S. and Umare S.S., Engineering Chemistry, 15th Edition, S. Chand Publishing, 2018.

Online Resources

- IEEE Electron Devices Society – https://eds.ieee.org
- SEMI – Semiconductor Manufacturing Standards – https://www.semi.org
- NPTEL Engineering Chemistry – https://nptel.ac.in

ENGINEERING GRAPHICS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
1	0	4	0	14	0	56	0	3	30	70	100

1. Course Objectives

- Familiarise students with BIS conventions, geometric construction standards, and engineering scales.
- Develop visualisation skills to interpret and project points, lines, and regular planes into 2D drawing sheets.
- Impart foundational knowledge on projecting regular 3D solids and reading directional geometric orientations.
- Enable the spatial reconstruction of sliced solids and flat unfolded developments of various structural shells.
- Introduce CAD tools combined with generative AI software to construct multi-view isometric representations from 3D models.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Construct engineering curves and scales using traditional drafting geometry validated by automated algorithmic paths.	L3 (Apply)
CO2	Solve multi-planar projection instances of linear points, segments, and standard regular planar silhouettes.	L3 (Apply) L4 (Analyze)
CO3	Render projections of standard 3D solids and identify variations using structural boundary algorithms.	L4 (Analyze)
CO4	Draft complex cross-sectional geometries and mapped surface extensions of sliced geometric forms.	L4 (Analyze)
CO5	Produce composite isometric layouts alongside generative text-to-CAD system alternatives for dynamic prototyping.	L5 (Evaluate) L6 (Create)

3. Course Syllabus

UNIT I	Introduction to Engineering Graphics, Curves, and Scales

Core Content:

Introduction: principles of Engineering Graphics, BIS conventions, and lettering. Curves: construction of polygons, conic sections (ellipse, parabola, and hyperbola using eccentricity/general methods), cycloidal curves and involutes. Scales: plain, diagonal, and Vernier scales.

AI Integration:

AI prompt engineering for generating geometric profiles; algorithmic generation of conic curves using mathematical code blocks; parsing hand-drawn geometric sketches into clean vector shapes using Computer Vision (CV) edge detection (Canny Edge/Hough Transform).

Free/Open-Source AI Tools:

Python (NumPy, Matplotlib, OpenCV) on Google Colab (free); AutoCAD student version (free); ChatGPT / Gemini for geometric concept explanation

UNIT II — Orthographic Projections of Points, Lines and Planes

Core Content:

Principles of orthographic projections, projection of points in all four quadrants. Projection of straight lines inclined to one or both reference planes, traces of lines, determination of true lengths and true inclinations. Projections of Planes: regular planes perpendicular to both reference planes, parallel to one reference plane and inclined to the other; planes inclined to both reference planes.

AI Integration:

Machine learning pipelines for 3D coordinate estimation from 2D views; multi-view structural tracking; training neural models to predict true line length and orientation angles based solely on coordinate projections.

Free/Open-Source AI Tools:

Python (NumPy, Matplotlib) on Google Colab (free); AutoCAD student version (free); AI tools: ChatGPT / Gemini

UNIT III — Projection of Regular Solids

Core Content:

Types of solids: polyhedra and solids of revolution. Projections of solids in simple positions: axis perpendicular to horizontal plane, axis perpendicular to vertical plane, axis parallel to both reference planes. Projection of solids with axis inclined to one reference plane and parallel to another.

AI Integration:

Object recognition models (e.g., YOLO / MobileNet) trained to identify standard solid geometries; automated multiview projection generation from 3D CAD meshes using programmatic render layers.

Free/Open-Source AI Tools:

Python (scikit-learn, TensorFlow, OpenCV) on Google Colab (free); AutoCAD student version (free); FreeCAD (free open-source CAD)

UNIT IV — Sections of Solids and Development of Surfaces

Core Content:

Sections of Solids: perpendicular and inclined section planes, sectional views and true shape of section, sections of solids in simple positions only. Development of Surfaces: methods of development — parallel line development and radial line development; development of a cube, prism, cylinder, pyramid, and cone.

AI Integration:

Generative Adversarial Networks (GANs) for generating flat-pattern configurations; algorithmic optimization of surface layouts to minimize sheet manufacturing scrap; predictive toolpath generation using physics-guided heuristic networks.

Free/Open-Source AI Tools:

Python (NumPy, Matplotlib, DEAP library) on Google Colab (free); AutoCAD student version (free); AI tools: ChatGPT / Gemini

UNIT V — Isometric Projections, Conversions, and Computer Graphics

Core Content:

Principles of isometric projection, isometric scale, isometric views/projections of planes, simple and compound solids. Conversion of isometric views to orthographic views and vice-versa. Computer Graphics: creating 2D and 3D drawings of objects including PCB and transformations using AutoCAD (not for end examination).

AI Integration:

2D-to-3D depth reconstruction using Neural Radiance Fields (NeRF) or specialized generative models; auto-generation of 3D CAD models from simple multi-view engineering layout sketches.

Free/Open-Source AI Tools:

Python (NumPy, Open3D, Matplotlib) on Google Colab (free); AutoCAD student version (free); FreeCAD (free); AI tools: ChatGPT / Gemini

4. Books and Materials

Textbooks

1. Bhatt N.D., Engineering Drawing, Charotar Publishing House, 2016.
2. Jolhe D., Engineering Drawing with an Introduction to AutoCAD, Tata McGraw Hill, 2017.

Reference Books

1. Jain P., Gautam A.P. and Bhargava A., Engineering Graphics and Design, Khanna Publishing.
2. Narayana K.L. and Kannaiah P., Engineering Drawing, Tata McGraw Hill, 2013.
3. Shah M.B. and Rana B.C., Engineering Drawing, Pearson Education, 2009.

Online Resources

1. NPTEL Engineering Graphical Design Course by IIT Kharagpur
2. OpenCV Official Python Bootcamps and Tutorials
3. AutoCAD Student Version – https://www.autodesk.com/education
4. FreeCAD (free open-source CAD) – https://www.freecad.org

NETWORK ANALYSIS

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
3	0	0	0	42	0	0	0	3	30	70	100

1. Course Objectives

- To understand types of circuit elements, source transformations, and methods of mesh and nodal analysis for resistive networks.
- To apply fundamental network theorems for circuit simplification and problem solving.
- To analyse transient responses of RL, RC, and RLC circuits and solve them using differential equations and Laplace transform techniques.
- To perform steady-state AC circuit analysis using impedance, phasor notation, and resonance concepts.
- To characterise two-port networks using parameters and apply them to cascaded and matched network configurations.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Analyse resistive networks using mesh analysis, nodal analysis, source transformations, and network theorems (Thevenin's, Norton's, Superposition, Maximum Power Transfer) to determine voltages, currents, and power in circuits with dependent sources.	L3 (Apply) L4 (Analyse)
CO2	Apply Laplace transform techniques and initial condition procedures to solve transient responses of first-order RL and RC circuits and second-order RLC circuits under DC and AC excitation.	L3 (Apply) L4 (Analyse)
CO3	Perform steady-state AC circuit analysis using phasor notation, complex impedance, and Star-Delta conversion for series and parallel R-L-C circuits using mesh and nodal methods.	L3 (Apply)
CO4	Evaluate series and parallel resonance characteristics including resonant frequency, Q-factor, and bandwidth, and analyse magnetically coupled circuits using self-inductance, mutual inductance, and the dot rule.	L4 (Analyse) L5 (Evaluate)
CO5	Derive and apply Z, Y, h, and ABCD two-port network parameters for the analysis, cascading, and design of attenuators, pads, and impedance matching networks.	L4 (Analyse) L5 (Evaluate)

3. Course Syllabus

UNIT I	Circuit Analysis of Resistive Networks & Network Theorems

Core Content:

Types of circuit components, types of sources and source transformations, mesh analysis and nodal analysis, problem solving with resistances only including dependent sources. Principle of duality with examples. Network Theorems: Thevenin's, Norton's, Reciprocity, Superposition, and Maximum Power Transfer theorems — problem solving using dependent sources.

AI Integration:

Use AI/LLM tools to explain mesh and nodal analysis with step-by-step worked examples; solve resistive circuits using KVL/KCL and prints branch currents; prepare a mesh vs. nodal comparison table and validate it using AI tools.

Free/Open-Source AI Tools:

Python (NumPy, SymPy) on Google Colab; PartSim, Falstad Circuit Simulator; ChatGPT / Gemini; NPTEL Network Analysis lectures.

UNIT II — Transients & Laplace Transform

Core Content:

First-order differential equations, definition of time constants, R-L circuit and R-C circuit with DC excitation, evaluating initial conditions procedure. Second-order differential equations — homogeneous and non-homogeneous — problem solving using R-L-C elements with DC and AC excitation. Laplace transform: introduction, basic theorems, problem solving using Laplace transform, and partial fraction expansion.

AI Integration:

Use AI/LLM tools to explain the time constant of RL/RC circuits and sketch voltage/current evolution; plot step responses and shows how τ shifts with component values; demonstrate partial fraction expansion and Laplace-based RLC solutions, check answers against initial and final conditions.

Free/Open-Source AI Tools:

Python (NumPy, SciPy, Matplotlib) on Google Colab; Scilab; Falstad Circuit Simulator; ChatGPT / Gemini; NPTEL video lectures.

UNIT III — Steady State Analysis of AC Circuits

Core Content:

Impedance concept, phase angle, series R-L, R-C, and R-L-C circuits — problem solving. Complex impedance and phasor notation for R-L, R-C, and R-L-C circuits — problem solving using mesh and nodal analysis. Star-Delta conversion.

AI Integration:

Use AI/LLM tools to explain impedance, admittance, and phasor notation; solve a series R-L-C circuit for Z, I, and phase angle. plot impedance vs. frequency to identify resonant frequency; demonstrate Star-Delta conversion and compare series vs. parallel R-L-C behaviour.

Free/Open-Source AI Tools:

Python (NumPy, Matplotlib) on Google Colab; Falstad Circuit Simulator; AC phasor calculators online; ChatGPT / Gemini; NPTEL AC circuits lectures.

UNIT IV — Resonance & Coupled Circuits

Core Content:

Resonance: introduction, definition of Q-factor, series resonance, bandwidth of series resonance, parallel resonance, general case with resistance in both branches. Coupled Circuits: self-inductance, mutual inductance, coefficient of coupling, analysis of coupled circuits, natural current, dot rule of coupled circuits — problem solving.

AI Integration:

Use AI/LLM tools to explain resonant frequency, Q-factor, and bandwidth; verify f_o and Q and confirm bandwidth = f_o/Q, plot the frequency response; mark the −3 dB points, read bandwidth, and compare with analytical results; apply the dot rule to a coupled circuit for polarity verification.

Free/Open-Source AI Tools:

Python (NumPy, SciPy, Matplotlib) on Google Colab; Falstad Circuit Simulator; ChatGPT / Gemini; NPTEL resonance and coupled circuits lectures.

UNIT V	Two-Port Networks

Core Content:

Relationship of two-port networks, Z-parameters, Y-parameters, Transmission (ABCD) parameters, h-parameters, relationships between parameter sets. Series and parallel connection of two-port networks, cascading of two-port networks — problem solving using dependent sources. Insertion loss, attenuators and pads, impedance matching networks.

AI Integration:

Use AI/LLM tools to explain Z, Y, h, and ABCD parameters and demonstrate Z-to-Y conversion via matrix inversion; compute and validate Z/Y parameters; explain ABCD cascading and verify output voltage for two cascaded T-networks with a given load.

Free/Open-Source AI Tools:

Python (NumPy) on Google Colab; two-port network calculators online; ChatGPT / Gemini; NPTEL two-port network lectures; Scilab.

4. Books and Materials

Textbooks

1. Van Valkenburg M.E., Network Analysis, Revised 3rd Edition, Prentice Hall of India, 2019.
2. Hayt W.H., Kemmerly J., and Durbin S.M., Engineering Circuit Analysis, 9th Edition, McGraw-Hill, 2020.

Reference Books

1. Roy Choudhury D., Networks and Systems, New Age International Publications, 2013.
2. Edminister J. and Nahvi M., Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill, 2017.
3. Ryder J.D., Network Lines and Fields, 2nd Edition, PHI.
4. Alexander C.K. and Sadiku M.N.O., Fundamentals of Electric Circuits, McGraw-Hill Education.

Online Resources

1. NPTEL: Network Analysis – https://nptel.ac.in/courses/108104002
2. MIT OpenCourseWare – Circuits and Electronics: https://ocw.mit.edu/courses/6-002
3. Falstad Circuit Simulator (free online): https://www.falstad.com/circuit
4. Python / Google Colab: https://colab.research.google.com
5. PartSim Free Circuit Simulator: https://www.partsim.com
6. Scilab (free MATLAB alternative): https://www.scilab.org
7. Python (NumPy, SciPy, Matplotlib) – FREE on Google Colab for circuit simulation and Laplace transform analysis
8. Scilab (free, open-source) – For matrix-based circuit and two-port network computations
9. Falstad Circuit Simulator (free, open-source) – For interactive circuit visualisation and transient analysis
10. PartSim (free online) – SPICE-based circuit simulation for verification
11. ChatGPT / Gemini (free tiers) – AI/LLM tools for concept explanation and step-by-step problem walkthrough
12. NPTEL Video Lectures – Free network analysis and circuit theory courses

DESIGN THINKING

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
1	0	4	0	14	0	56	0	3	30	70	100

1. Course Objectives

- Introduce students to the philosophy, origin, and relevance of Design Thinking in human-centred problem solving and engineering innovation.
- Develop empathy-driven research skills using interviews, observation, and user personas to define meaningful problem statements.
- Enable ideation using structured creative techniques augmented by AI tools for idea generation and concept selection.
- Equip students with prototyping skills across low-fidelity paper and high-fidelity digital formats using AI-powered design tools.
- Develop user testing, iteration, and pitching competencies — integrating AI throughout the full design cycle.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Level
CO1	Recall and understand the philosophy, principles, and stages of the Design Thinking process and its relevance to human-centred problem solving.	L1 (Remember) L2 (Understand)
CO2	Apply empathy tools (interviews, observation, personas) and problem-framing techniques to real-world engineering scenarios.	L3 (Apply)
CO3	Analyse user needs and problem statements using the 'How Might We' framework and AI-powered insight generation tools.	L4 (Analyze)
CO4	Evaluate and select the most viable prototype solution through structured testing, user feedback, and AI-assisted evaluation rubrics.	L5 (Evaluate)
CO5	Create innovative prototypes and pitch solutions to identified problems using AI ideation tools and digital prototyping platforms.	L6 (Create)

3. Course Syllabus

UNIT I	Introduction to Design Thinking

Core Content:

Design Thinking: definition, origin (Stanford d.school, IDEO), and relevance to engineering. The 5-Stage Model: Empathise – Define – Ideate – Prototype – Test. Human-centred design principles: Desirability, Feasibility, Viability. Systems Thinking vs. Linear Thinking: understanding complexity. Case Studies: IDEO shopping cart, Stanford Mobile Clinic.

AI Integration:

Use AI to explain design thinking in different domains (healthcare, education, agriculture), create a mindmap of the 5-stage process, Watch an IDEO documentary and use AI to summarise key DT principles observed.

Free/Open-Source AI Tools:

ChatGPT / Copilot (free tiers); MindMeister (free) / FreeMind (free open-source); Gemini (free)

UNIT II	Empathise and Define Stages

Core Content:

Empathy Methods: interviews, observation, immersion, shadowing. Creating User Personas: demographic, psychographic, goals and pain points. Empathy Mapping: Says, Thinks, Does, Feels. Point of View (POV) Statement: User + Need + Insight formula. How Might We (HMW) Questions: reframing problems as opportunities.

AI Integration:

Create digital empathy maps and POV statements collaboratively, generate diverse user persona profiles for a given problem context, Interview 5 peers about a campus problem; use AI to analyse interview transcripts and extract themes, affinity mapping of qualitative research data

Free/Open-Source AI Tools:

Miro (free plan); Dovetail (free plan); ChatGPT / Gemini (free tiers)

UNIT III	Ideation Stage

Core Content:

Creative Thinking Techniques: brainstorming, brainwriting, SCAMPER, random word association. Lateral Thinking: Edward de Bono's Six Thinking Hats. Affinity Diagramming: grouping ideas by themes. Prioritisation Matrix: Impact vs. Effort, Dot Voting. Concept Selection: morphological charts and Pugh Matrix.

AI Integration:

Use 'expand my idea' prompts to generate 20 variations of a concept, digital brainstorming and affinity diagramming, generate visual concept sketches from text descriptions, run a 30-minute AI-augmented brainstorming session and compare idea quality with pure human brainstorming

Free/Open-Source AI Tools:

ChatGPT / Gemini (free tiers); IdeaFlip (free) / Miro (free plan); DALL-E 3 via ChatGPT (free credits) for visual concept sketches

UNIT IV	Prototyping

Core Content:

Principles of Prototyping: low-fidelity vs. high-fidelity prototypes. Paper Prototyping: sketching UI and physical models. Digital Wireframing: introduction to wireframes and mockups. 3D Prototyping Concepts: introduction to 3D printing and rapid prototyping. Role Plays and Experience Prototyping: service design scenarios.

AI Integration:

Ceate digital wireframes and interactive mockups, convert hand-drawn sketches to digital wireframes using AI, create simple 3D models for physical prototyping, build a paper prototype for a chosen problem and photograph for digital documentation

Free/Open-Source AI Tools:

Figma (free plan); Uizard (free plan, AI-powered); Tinkercad (free, web-based); ChatGPT / Gemini for idea refinement

UNIT V	Testing, Iteration and AI in Design

Core Content:

User Testing Methods: think-aloud protocol, A/B testing, usability testing. Feedback Analysis: affinity mapping of test feedback. Iteration Cycle: incorporating feedback and pivoting. Design Presentation: pitching to stakeholders (elevator pitch, demo day format). AI in Design: overview of AI-assisted design (generative design, co-creation with AI).

AI Integration:

Conduct remote usability tests on Figma prototypes, analyse collected user feedback and generate insights and improvement suggestions, present a final prototype to a panel; use AI to prepare pitch slides in Canva, create a Design Thinking journal documenting each stage with AI tool usage notes

Free/Open-Source AI Tools:

Maze (free plan); Canva (free); ChatGPT / Gemini (free tiers); Figma (free plan)

4. Books and Materials

Textbooks

1. Brown T., Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperBusiness, 2019.
2. Lewrick M., Link P. and Leifer L., The Design Thinking Playbook, Wiley, 2018.

Reference Books

1. IDEO.org, The Field Guide to Human-Centered Design, IDEO.org, 2015.
2. Kelley T. and Kelley D., Creative Confidence, Crown Business, 2013.
3. Liedtka J. and Ogilvie T., Designing for Growth, Columbia Business School Press, 2011.

Online Resources

1. Stanford d.school Resources – https://dschool.stanford.edu/resources
2. IDEO Design Kit – https://www.designkit.org/methods
3. Interaction Design Foundation – https://www.interaction-design.org
4. NPTEL Design Thinking – https://swayam.gov.in

ELECTRONICS AND ELECTRICAL ENGINEERING WORKSHOP

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	2	0	0	0	28	1	30	70	100

1. Course Objectives

- Gain hands-on proficiency in workshop tools, measuring instruments, and electronic components through assembly, testing, and theoretical vs. measured value comparison.
- Understand electrical systems and implement verified DC and AC circuits on breadboard and PCB experimentally.
- Measure and interpret electrical parameters — real power, power factor, earth resistance, and energy consumption — using standard instruments such as wattmeter, Megger, and energy meter.
- Apply Python and AI/LLM tools to automate data analysis, simulate circuit behaviour, and validate experimental results through regression and predictive modelling.
- Design a socially relevant mini project using AI/LLM tools and Python/MATLAB for simulation, analysis, and prediction.

2. Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Identify, handle, and test workshop tools, instruments, and electronic components; assemble and verify DC and AC circuits on breadboard and PCB using appropriate measuring instruments.	L3 (Apply)
CO2	Calculate electrical energy consumption and power factor; implement and validate circuits through simulation and hardware, comparing experimental results with theoretical values.	L3–L4 (Apply, Analyse)
CO3	Apply AI/LLM and/or Python/MATLAB tools for data analysis, simulation, and report generation; design and demonstrate a mini project with societal application integrating AI and hardware.	L5–L6 (Evaluate, Create)
CO4	Measure earth resistance, real power, and power factor using standard instruments (Megger, wattmeter); compare readings against IS/IEEE permissible limits and interpret results.	L4 (Analyse)
CO5	Automate measurement data processing, energy prediction, and fault detection using Python (NumPy/Matplotlib/Scikit-learn); evaluate model accuracy using appropriate metrics.	L5–L6 (Evaluate, Create)

3. Course Syllabus

Part A – Regular Activities

- Familiarization of commonly used workshop tools like breadboard, soldering iron, relays, switches, connectors, fuses, cutters, pliers, wire stripper, etc.; exercises for proper handling and usage.
- Familiarization with voltmeters, ammeters, multimeter, LCR meter, power supplies, CRO/DSO, function generator, and frequency counter; perform basic measurement experiments.
- Identification of components (R, L, C, diodes, transistors, ICs) — type, symbol, colour coding, and package; testing and comparison of theoretical vs. measured values.
- Study of fundamental electrical concepts — voltage, current, power, AC/DC, single-phase, three-phase; understanding the working principles of transformers, generators, and motors.

- Calculate energy consumption of domestic appliances and/or a premises using standard formulas; record and tabulate energy usage data for a given set of loads.
- Measure real power and power factor of a single-phase AC circuit using a wattmeter; tabulate readings for different load conditions.
- Measure earth resistance of the laboratory grounding electrode using a Megger instrument; tabulate readings and compare with permissible safety limits.
- Assemble any two circuits — one with a DC source and one with an AC source — on a breadboard and test their functionality; observe and record output waveforms or measured parameters.
- Assemble any two circuits — one with a DC source and one with an AC source — on a PCB and test their performance; compare measured results with expected values.
- Design and implement an electronic or hobby circuit with a societal application (e.g., energy monitoring system, sensor-based automation, fault detection system); demonstrate working functionality.

Part B – AI Integration Lab Exercises

- Any **five** activities must be implemented using appropriate AI/LLM tools and/or Python/MATLAB-based simulations.

Activity 1

a) Use AI/LLM tools to query tool datasheets and manufacturer specifications; generate an interactive Q&A to identify tool functions, correct handling postures, and safety hazards for each workshop tool.

b) Use LLM-generated safety checklists to create a Python-based scoring tool that evaluates a student's handling procedure against a standard rubric.

Activity 2

a) Use AI/LLM tools to explain the operating procedures of each instrument (CRO/DSO, LCR meter, function generator) and to interpret measurement results — including scale reading, range selection, and source of error.

b) Use Python (NumPy/Matplotlib) to plot measured voltage and current data; apply linear regression to verify Ohm's Law and estimate percentage error from ideal values.

Activity 3

a) Use AI/LLM tools for AI-assisted component identification — describe a component by its markings or package and receive datasheet summary, pin-out, and typical application; understand colour-code decoding for resistors and capacitors.

b) Use Python (Scikit-learn) regression to estimate device parameters (static resistance, capacitance, inductance) from LCR meter readings and compare with datasheet nominal values.

Activity 4

a) Use AI/LLM tools to relate fundamental electrical concepts (voltage, current, power factor, single/three-phase systems) to real-world applications — household wiring, industrial motors, and transformer ratings; generate concept maps.

b) Use Python to simulate single-phase and three-phase phasor diagrams (Matplotlib); model transformer turns ratio and calculate secondary voltage for given primary inputs.

Activity 5

a) Use AI/LLM tools to explain energy billing calculations, units (kWh), tariff slabs, and the impact of power factor on energy cost; generate a structured energy audit report for a given premises.

b) Use Python (Google Colab/Scikit-learn) to model and predict monthly energy consumption using linear regression; input appliance wattage and daily usage hours as features.

Activity 6

a) Use AI/LLM tools to explain power factor, reactive power compensation, and the effect of capacitive/inductive loads; auto-generate a power quality summary from wattmeter readings.

b) Use Python/MATLAB to plot real power, reactive power, and power factor against load variation; apply regression to model the relationship between load impedance and power factor.

Activity 7

a) Use AI/LLM tools to explain earth resistance standards (IS 3043/IEEE 80), the fall-of-potential method used by Megger, and the significance of low earth resistance for human safety; auto-generate a safety compliance report.

b) Use Python to analyse tabulated Megger readings; flag values exceeding safety thresholds using a rule-based classifier and plot resistance vs. electrode depth.

Activity 8

a) Use AI/LLM tools to interpret the circuit schematic, suggest component values, and debug functional faults based on described symptoms (e.g., no output, distorted waveform, wrong DC level).

b) Use Python/MATLAB to simulate both the DC and AC circuits before hardware implementation; compare simulated waveforms or voltage levels with measured breadboard results.

Activity 9

a) Use AI/LLM tools for PCB layout guidance — component placement rules, trace width calculation for current capacity, and design-rule-check (DRC) criteria; generate a bill of materials (BOM) from the schematic.

b) Validate the PCB design using MATLAB/Python simulation prior to fabrication; compare simulated and measured performance and quantify deviation using percentage error analysis.

Activity 10

a) Use AI/LLM tools throughout the project lifecycle — problem statement framing, circuit design justification, component selection rationale, testing strategy, and final report generation including abstract, block diagram description, and conclusion.

b) Integrate Python/MATLAB for data acquisition, analysis, or prediction within the project (e.g., regression-based energy forecasting, threshold-based fault classifier, sensor signal processing); include model training, validation, and result visualisation.

AI Integration	AI integration covers five selected activities: (i) Python-based tool safety scoring; (ii) Ohm's Law verification via NumPy/Matplotlib linear regression; (iii) LCR meter data regression for component parameters; (iv) Python phasor diagrams and transformer modelling; (v) linear regression-based energy prediction — each reinforcing the link between physical experimentation and computational analysis.

Free / Open-Source AI Tools: Python (NumPy, Matplotlib, Scikit-learn) – Google Colab (free); LTspice / Falstad Circuit Simulator (free) – circuit simulation; Virtual Labs – IIT (free) – online electrical experiments.

Recommended Free & Open-Source AI / Computational Tools
Python (NumPy, Matplotlib, Scikit-learn) on Google Colab (free) – energy prediction, Ohm's Law regression, component parameter estimation
Scikit-learn (free, open-source) – linear regression and rule-based classifiers for energy forecasting and fault detection
LTspice / Falstad Circuit Simulator (free) – pre-hardware simulation of breadboard and PCB circuits
Virtual Labs – IIT (free): https://vlab.co.in – online simulation of electrical measurement experiments
LibreOffice Calc (free, open-source) – standardised data recording templates for all activities

ENGINEERING WORKSHOP

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	3	0	0	0	42	1.5	30	70	100

1. Course Objectives

- Create awareness on safety precautions required at the workplace.
- Master fundamental hand tools and traditional manufacturing craftsmanship.
- Practice manufacturing of components using workshop trades including fitting, sheet metal, carpentry, foundry, and welding.
- Impart basic electrical engineering knowledge for house wiring practice.
- Demonstrate fundamentals of foundry and welding.

2. Course Outcomes (COs)

On successful completion of the course, the student will be able to:

CO	Course Outcome Statement	Bloom's Level
CO1	Recognise the importance of safety precautions while working in the workshop.	L1 (Remember)
CO2	Identify different measuring, marking, and cutting tools used in the workshop and their operational capabilities.	L2 (Understand)
CO3	Fabricate precision wood and metal fitting joints within standard specifications.	L3 (Apply)
CO4	Understand wire standards, safe residential switches, lighting circuits, and basic appliances.	L2 (Understand)
CO5	Identify different tools used in foundry and welding sections.	L2 (Understand)

3. Course Syllabus

1. **Safety Practices & Precautions**

Demonstrate the necessity of Workshop hazards, various Personal Protective Equipment and emergency protocols.

AI Integration: Computer vision for safety compliance.

2. Wood working: Introduction to different types of woods, carpentry tools, timber joints

a) Half – Lap joint b) Mortise and Ten on joint c) Corner Dovetail joint or Bridle joint

3. Fitting: Familiarity with different types of tools used in fitting and perform fitting exercises like

a) V-fit b) Dovetail fit c) Semi-circular fit

4. Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

5. Electrical wiring: Introduction to electrical tools, safety precautions, wiring materials.

Familiarity with different types of basic electrical circuits and make the following connections.

a) Parallel and series b) Two-way switch c) God own lighting d) Tube light e) Three phase motor f) Soldering of wires

6. Plumbing: Introduction to plumbing tools, pipe fittings, thread cutting, making a simple PVC pipe joint. Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of a simple Lap joint/Butt joint.

8. Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for a simple Patterns.
9. Introduction to 3D Printing: Demonstrate the core concepts of 3D printing, Hardware, software, Digital file and 3D printing materials. Familiarise with 3D Printing Process of complex objects.
10. Computer Components:
Disassemble and reassemble a desktop computer to understand the role of each component (CPU, motherboard, RAM, HDD/SSD, GPU, etc.).
Hardware Troubleshooting & Peripheral Installation:
Simulate common hardware issues (e.g., RAM failure, CPU overheating) and identify the procedures to resolving them.
Peripheral Installation:
Install and configure peripheral devices such as printers, scanners, and external hard drives.
Network Setup and Configuration:
Set up a small LAN network with routers, switches, and computers. Configure IP addresses, subnet masks, and basic network services.
11. Disassembly and Assembly of equipment such as Bicycle, Gear Box, Braking System:
Familiarise with disassembly and assembly process

AI Integration Module: Smart energy monitoring using IoT current sensors; building machine learning load forecasting models; training anomaly detection systems to automatically flag electrical arc or leakage patterns. Develop predictive load-monitoring models that detect faulty configurations or phantom energy drains.

Books and Materials

Textbook (s)

1. **Workshop Core Reference**: *Workship Technology Vol I & II* by S.K. Hajra Choudhury, Media Promoters & Publishers.
2. **Workshop Core Reference**: *A Course in Workshop Technology* by B.S. Raghuwanshi, Dhanpat Rai & Co. 2015 & 2017
3. **Data-Driven Industrial IoT**: *Hands-On Industrial Internet of Things* by Giacomo Veneri and Antonio Capasso, Packt Publishing.
4. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
5. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22

Reference Book(s)

1. Manufacturing Technology (Foundry, Forming and Welding) by P.N. Rao, McGraw Hill.
2. An Introduction to Predictive Maintenance by R. Keith Mobley, Butterworth-Heinemann.

Online Learning Resources

- **Classical Shopfloor Operations**: NPTEL Workshop Practices Video Series by IIT Kharagpur
- **Industrial AI & Predictive Analytics**: Predictive Maintenance Models in Python Tutorial
- **Smart Sensors & Electronics Fabrication**: MIT 6.131: Power Electronics and Smart Grid Interfaces

ENGINEERING CHEMISTRY FOR ELECTRONICS AND COMMUNICATION SYSTEMS LAB

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	3	0	0	0	42	1.5	30	70	100

Course Objectives

- Perform classical wet chemical analyses (redox, acid-base) on industrially relevant systems including battery electrolytes and iron solutions.
- Determine corrosion rates and understand the influence of environmental factors using standard electrochemical and gravimetric methods.
- Apply instrumental methods—conductometry, potentiometry, spectrophotometry, and IR spectrophotometry—for quantitative and qualitative chemical analysis.
- Synthesise a polymer (Bakelite) and relate its properties to structure and industrial relevance for electronics applications.
- Automate experimental data analysis using Python and develop AI-based models for corrosion prediction and spectral analysis.

Course Outcomes (COs)

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

CO	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Perform redox and acid-base titrations (Experiments 1, 2); determine iron (Fe^{2+}) concentration using $K_2Cr_2O_7$ and acid strength in battery electrolytes; compute molarity, normality, and percentage strength from titre data; interpret equivalence point from titration curves.	L3 (Apply)
CO2	Measure corrosion rates by weight loss and electrochemical methods (Experiments 3, 4); evaluate the effect of environmental variables (pH, temperature, NaCl concentration) on corrosion behaviour; compute corrosion rate in mdd or mpy units and interpret passivation trends.	L3–L4 (Apply, Analyse)
CO3	Perform conductometric and potentiometric titrations (Experiments 5, 6, 7); identify equivalence points from conductance vs. volume and potential vs. volume plots; explain the difference in conductance profiles between strong-acid/strong-base and weak-acid/strong-base systems; determine concentration of unknown samples.	L4 (Analyse)
CO4	Synthesise Bakelite (Experiment 8); determine the wavelength of maximum absorption and verify Beer–Lambert law using spectrophotometry (Experiment 9); identify functional groups in organic compounds from IR spectra (Experiment 10); correlate absorption peaks with molecular structure.	L4–L5 (Analyse, Evaluate)
CO5	Automate titration curve plotting and endpoint detection using Python (NumPy/Matplotlib); develop an AI-based corrosion rate predictor using scikit-learn Random Forest regression; perform spectral regression to verify Beer–Lambert law and compute molar absorptivity; evaluate model performance using R^2 and RMSE.	L5–L6 (Evaluate, Create)

List of Experiments

Part A – Regular Experiments

1. Estimation of Ferrous Iron (Fe^{2+}) using Potassium Dichromate ($K_2Cr_2O_7$) – Redox Titrations
2. Determination of Strength of Acid in Lead Acid Battery
3. Determination of Corrosion Rate (Weight Loss Method)
4. Determination of Corrosion by Environment (Effect of pH, Salt Concentration, and Temperature)

Instrumental Methods of Chemical Analysis

5. Conductometric Titration of Strong Acid vs. Strong Base (HCl vs. NaOH)
6. Conductometric Titration of Weak Acid vs. Strong Base (CH_3COOH vs. NaOH)
7. Potentiometry (Redox Titration) – Estimation of Iron (Fe^{2+}) using Potassium Dichromate ($K_2Cr_2O_7$)
8. Preparation of a Polymer (Bakelite)
9. Spectrophotometry – Determination of Wavelength (λ) and Verification of Beer–Lambert Law
10. Identification of Functional Groups in Organic Compounds by IR Spectrophotometer

Part B – AI Integration Lab Exercises

- Titration Data Automation (Python / Google Colab): input burette readings from Experiments 1, 2, 5, 6, and 7; compute titre volumes, molarity, and strength; plot titration curves using Matplotlib; automate endpoint detection from conductance or potential vs. volume data.
- AI-Based Corrosion Prediction (scikit-learn): using a provided dataset of metal type, pH, temperature, salt concentration, and exposure time, train a Random Forest Regression model to predict corrosion rate; evaluate with R^2 and RMSE; compare predicted values with Experiment 3 and 4 results.
- Spectral Data Analysis (Python / NumPy): input absorbance vs. wavelength data from Experiment 9; plot absorbance spectrum; verify Beer–Lambert law by linear regression of absorbance vs. concentration; determine molar absorptivity (ε) and compare with standard values.

Free / Open-Source AI Tools: Python (NumPy, Matplotlib, scikit-learn) – Google Colab (free); LibreOffice Calc (free) – data recording; Virtual Chemistry Lab – VLabs IIT (free).

Recommended Free & Open-Source AI / Computational Tools

Recommended Free & Open-Source AI / Computational Tools
Python (NumPy, Matplotlib, scikit-learn) on Google Colab (free) – titration curve automation, spectral regression, AI corrosion prediction
scikit-learn (free, open-source) – Random Forest regression for corrosion rate prediction from environmental parameters
Virtual Chemistry Lab – VLabs IIT (free): https://chem-iitb.vlabs.ac.in – simulation of titrations, electrochemical and spectroscopic experiments
LibreOffice Calc (free, open-source) – standardised data recording templates for all experiments
ChemDraw / MolView (free online) – molecular structure drawing and IR peak prediction for Experiment 10

Web Resources

1. IEEE Electron Devices Society – https://eds.ieee.org
2. SEMI (Semiconductor Equipment and Materials International) – https://www.semi.org
3. Optica (OSA) – https://www.optica.org
4. IEC (International Electrotechnical Commission) – https://www.iec.ch
5. ECIA (Electronic Components Industry Association) – https://www.ecianow.org

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
0	0	0	1	0	0	0	14	0.5	30	70	100

1. Course Objectives

- Inculcate the spirit of volunteerism, patriotism and social responsibility among students.
- Enable students to understand the structure, objectives and working of NSS, NCC, Scouts & Guides.
- Develop leadership, communication, teamwork and crisis-management skills through experiential learning.
- Equip students with basic first-aid and disaster-preparedness competencies.
- Promote community engagement and sustainable development values through organised service activities.

2. Course Outcomes (COs)

CO	Course Outcome Statement	Bloom's Level
CO1	Understand the philosophy, history, and objectives of NSS/NCC/Scouts & Guides and community service programmes.	L1–L2 (Remember / Understand)
CO2	Demonstrate leadership, teamwork, and organisational skills through camp/parade/drill activities.	L3 (Apply)
CO3	Plan and execute community service projects addressing social issues like health, hygiene, literacy, and environment.	L3–L4 (Apply / Analyse)
CO4	Apply first aid, disaster-preparedness, and civic responsibilities in real-world scenarios.	L3 (Apply)
CO5	Develop civic sense, national integration, and sustainable community-development values.	L5 (Evaluate)

3. Course Syllabus

UNIT I: Foundation of NSS, NCC, Scouts & Guides and Community Service

Core Content:

- Introduction to NSS – history, objectives, badge, motto, pledge
- Introduction to NCC – ranks, uniforms, aims, NCC Act 1948
- Scouts & Guides – Baden-Powell legacy, Bharat Scouts & Guides Act
- Community Service – concept, importance and types
- Citizenship, civic sense and social responsibility
- Volunteerism: global and Indian perspective (NYKS, NSS, Red Cross)
- Legal & ethical framework for community service)

UNIT II: Leadership, Skill Development, Camping and Disaster Management

Core Content:

- Leadership development – theories and models (situational, transformational)
- Team building, communication & conflict resolution
- Parade, drill & physical training basics
- Map reading, navigation and field craft (NCC)
- Camp organisation – planning, logistics, safety protocols
- Adventure activities: trekking, rock-climbing, swimming (awareness)
- Disaster management – concepts, types, roles of NSS/NCC volunteers
- First Aid – CPR, wound management, fractures, snake bite, burn

UNIT III: Community Projects, Social Awareness and Service Documentation

Core Content:

- Community needs assessment – participatory methodology
- Project planning: Swachh Bharat, Pulse Polio, Blood Donation camps
- Literacy campaigns and awareness drives (PadhnaLikhna Abhiyan)
- Environmental conservation – plantation, solid waste, water conservation
- Gender sensitisation and women empowerment programmes
- Digital literacy and e-governance outreach
- Documentation and reporting of service-learning activities
- Reflection, portfolio preparation and field report writing.

Books and Materials

Textbook (s)

1. Ministry of Youth Affairs & Sports, Govt. of India NSS Training Manual, MYAS Publication, 2022.
2. Directorate General NCC, National Cadet Corps-Training Syllabus & Manual, DG NCC New Delhi, 2021

Reference Book(s)

1. Dr S K Lal, Community Development & Social Service, Regal Publications, 2019.
2. Satish Modh, Disaster Management – A Holisitc Approach, Macmillan India, 2020.
3. Steve McCurley & Rick Lynch, Volunteer Management, Energize Publications, 2018
4. Lord Robert Baden Powell, Scouting for Boys, Oxford University Press (Centenary Ed.), 2008

Online Learning Resources

- NSS Official Portal – https://nss.gov.in
- NCC Official Site – https://indiancc.mygov.in
- Bharat Scouts & Guides – https://bsgindia.org
- UN Volunteers – https://www.unv.org
- NYKS (Nehru Yuva Kendra) – https://nyks.nic.in
- National Disaster Management Authority – https://ndma.gov.in
- Swachh Bharat Mission – https://swachhbharat.mygov.in
- India Volunteers – https://www.indiavolunteers.org