DEPARTMENT OF MECHANICAL ENGINEERING

A.Y:2026-27

DR26 Regulations

Course Structure & Syllabus

B. Tech - I Semester and II Semester

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)

(Accredited with A^{++}Grade by NAAC & Accredited by NBA (B. Tech-CSE, ECE & EEE))

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DR26

B.Tech (Regular-Full time) Programme

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

&

B.Tech (Lateral Entry Scheme)

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

INSTITUTE VISION

To evolve as Quality Institution in Teaching, Innovative Research, Entrepreneurship and Consultation in Engineering & Technology, empower rural youth globally competent and self-disciplined technocrats.

INSTITUTE MISSION

IM_1: Inculcate technical knowledge, soft skills through student centric teaching & learning.

IM_2: Strengthen industry institute interaction, provide solutions to the ever-changing requirements.

IM_3: Implant entrepreneurial attitude and ethical values.

IM_4: Create work culture towards learning, Research & Development.

IM_5: Develop a unique practice that in stills responsibility and accountability among the stake holders

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Academic Regulations (DR26)

for B. Tech (Regular-Full time)

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

DNR College of Engineering &Technology (Autonomous), Bhimavaram, West Godavari is permanently affiliated to Jawaharlal Nehru Technological Institute, Kakinada offering Undergraduate and Postgraduate programmes to the students admitted in this college in different disciplines.

1. Introduction

The B.Tech., B.Tech. with Minor, and B.Tech. with Honours programmes are designed in accordance with the broad academic framework and curricular principles of AICTE, APSCHE, UGC and NEP 2020, with an emphasis on Outcome Based Education (OBE), multidisciplinary learning, experiential learning, innovation, research, entrepreneurship, employability, and holistic development.

The curriculum comprises Basic Sciences, Humanities, Social Sciences, Management, Engineering Sciences, Professional Core, and Professional Electives including industry-oriented courses, Open/Interdisciplinary Electives, and emerging areas, along with laboratories, internships, projects, and other experiential-learning components. The curriculum progressively develops students' knowledge, technical skills, professional competencies, ethical values, communication abilities, and capability to address real-world engineering and societal challenges.

The programme structure broadly progresses through three stages:

Phase I-Foundation:

- Provides a strong foundation in Mathematics, Basic Sciences, Humanities and Social Sciences, communication, computational thinking, and fundamental engineering concepts.

Phase II-Engineering Foundation:

- Focuses on Engineering Sciences and foundational engineering practices in Interdisciplinary Subjects, Industry 4.0 technologies, Computer programming to improve their logical skills, Artificial Intelligence and Machine learning, Practical exposure to relevant Engineering workshops, and other common engineering courses, supported by laboratories and hands-on learning.

Phase III-Professional Learning:

- Provides discipline-specific Professional Core and Professional Elective courses that develop competencies to learn basic principles and concepts in their professional core subjects, problem identification, analysis, modelling, design, development, experimentation, and implementation, with exposure to contemporary technologies and industry practices.

The curriculum promotes experiential and practice-based learning through laboratories, mini-projects, design activities, internships, industry/community interaction, field-based learning, and

major projects. It also provides flexibility through Professional Electives, Open/Interdisciplinary Electives, Minor, Honours, and other approved academic pathways, enabling students to pursue multidisciplinary and specialized areas aligned with their interests and career aspirations.

Students are progressively introduced to research methodology, innovation, design thinking, entrepreneurship, emerging technologies, computational tools, experimentation, technical documentation, and professional communication. Internships and projects providing opportunities to apply theoretical knowledge to practical and real-world problems and develop teamwork, leadership, problem-solving, and project-management skills.

The curriculum is periodically reviewed and revised through the Board of Studies and other statutory academic bodies, considering the guidelines of AICTE, APSCHE, UGC and NEP 2020, accreditation requirements, industrial requirements, emerging technologies, societal requirements, and stakeholder feedback.

The curriculum follows Outcome Based Education, with Course Outcomes (COs) appropriately aligned with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs). Teaching-learning and assessment processes are designed to facilitate progressive attainment of the expected graduate competencies.

The course structure, syllabi, credit requirements, academic progression, internship and project requirements, and provisions for B.Tech., B.Tech. with Minor and B.Tech. with Honours shall be governed by the applicable Institute Regulations and approved academic framework. The student is having the option to consider either one minor / Honour (or) two minors (or) one minor and Honour along with Regular B.Tech programme, depending on his interest and satisfying the regulations. The detailed curriculum and syllabi shall be made available through the official Institute website: https://dnrcet.org/web/

1.1 Organizational Structure for Academic Administration

The academic programmes of the Institute are governed by Rules and Regulations approved by the Academic Senate from time to time. The Academic Senate is a statutory and supreme body that governs all academic matters of the Institute, and the rulings of Senate Chairperson (Vice-Chancellor) are final in regard to all academic issues. A definite time schedule is set by the Senate for various academic activities, through an Academic Calendar issued at the beginning of each academic year.

The Academic Senate continuously assesses the academic programmes and makes appropriate

revisions/ modifications/ improvements as and when required through Board of Studies. The Director Academics is the Convener for the committee. Similarly, the performance and evaluation related

issues of the Academics are monitored by the Academic Senate. Convener of the committee is designated from among Senate members.

1.2 Academic Calendar

The academic activities of the Institute are regulated by the Academic Calendar approved by the Academic Senate, and released at the beginning of each academic year. It is mandatory for students / faculty/ Principals' of affiliated, constituent Units, to strictly adhere to the academic calendar for completion of academic activities. The Academic Calendar can be noted in Institute website: https://dnrcet.org/web/

2. Curriculum / Programme of Study

2.1 Curriculum

Every Department has a prescribed course structure which, is known as the Curriculum. It prescribes the courses, labs and other requirements for award of the degree and sets out the nominal sequence semester-wise. It also gives the syllabus and a list of textbooks, reference books and online material for each course. The Curriculum details are made available at the Institute website.

2.2 Semester

The Institute follows a credit-based semester system, comprising two regular semesters in each academic year. Autumn semester (Semester I / Odd Semester) generally commences in July/August, while the Spring semester (Semester II / Even Semester) commences in January. During the summer vacation (May–June), students may be engaged in industry internships, research internships, community-based learning, or other approved experiential-learning activities, as prescribed in the respective programme regulations. The credits shall be allocated as per the regulations.

2.3 Course Credit Structure

In general, a certain quantum of academic work measured in terms of credits is laid down as the requirement for a particular degree. A student earns credits by satisfactorily clearing courses / other academic activities every semester. The credits associated with a course / other academic activity is dependent on the number of contact hours.

2.3.1Theory and Laboratory Courses

Courses are broadly classified as Theory Courses and Laboratory Courses. Theory courses consist of lecture (L) and tutorial (T) hours, but may have attached practical / practice (P) hours in special cases. Laboratory courses consist of practical hours, but may have attached tutorial hours in special cases. Credit (C) for a course is obtained by multiplying the number of hours of instruction per
week in that course, by one (1) for lecture and tutorial hours, and by ½ (0.5) for laboratory hours, i.e., C= L + T + 0.5*P.
Two examples of credit calculation are shown below:

Theory Course					Laboratory Course			
L	T	P	C		L	T	P	C
3	0	0	3		0	0	3	1.5

In the Courses of Study, if a theory course is shown as, say, CE304 Soil Mechanics II: 3 0 0 3, it means that CE304 is the course code, Soil Mechanics II is the course title and 3 0 0 3 corresponds to L T P C, i.e., Lectures, Theory, Practical and Credits, respectively. Other academic activities consist of a Seminar, Projects, which carry credits. Mandatory Non-credit Courses e.g., NSS/ NCC / Sports / Yoga, Indian constitution, Environmental Sciences, Research Methodology, other courses for societal relevance awareness / knowledge to implement their domain knowledge for further improvement of society in which the student gets the award of Satisfactory or Un-Satisfactory grades based on regulations provided.

3. Minimum Credit Requirements for the Award of Undergraduate Degree

A student shall be eligible for the award of the B.Tech. degree upon satisfying the following requirements:

1. The student shall complete the programme in not less than four academic years and not more than eight academic years from the date of admission.
2. The student shall register and successfully earn 164 credits prescribed for the B.Tech. Programme, and secures a CGPA of not less than 5.0.
3. 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 admission in B.Tech. programme and their admission stands cancelled, automatically.

4.Opportunities for Additional Learning: MINOR, HONOURS

4.1 Award of B.Tech. Degree with Minor

Minor is an additional credential a student may earn if s/he does 18 credits worth of additional courses in a discipline other than her/his discipline of B.Tech. degree of his admission. All the

affiliated / autonomous institutes of the Institute offer minors in their disciplines, and shall prescribe a specific set of courses and/or projects necessary for earning a minor in that discipline.

A student must pre-register for a minor course which is finally allotted on the basis of highest CGPA. S/he accumulates credits by registering for the required courses, and if the requirements for a particular minor are met within the prescribed time limit for the programme,

the minor will be awarded. This will be mentioned in the Degree Certificate e.g., "*Bachelor of Technology in Civil Engineering with Minor in CSE*." This will also be reflected in the transcript, along with the list of courses studied.

Since the number of students to be admitted for each of the Minor programme is limited, one has to compete with the rest of the students to get admitted in Minor Programme.

If 18 credits are not completed for Minor then Minor will not be awarded. The individual course credits earned, however, will be reflected in the separate grade sheet. For the award of the minor, all requirements towards the basic degree and the minor have to be completed within the stipulated period of the programme one registers for.

A student shall be eligible for the award of the B.Tech. degree with a Minor upon satisfying the following requirements:

- 4.1.1 May register before commencement of II-I Semester and classwork commences from II-I semester of the B.Tech degree.
- 4.1.2 Registration for the Minor programme shall be optional.
- 4.1.3 Successfully complete an additional 18 credits prescribed for the Minor programme, simultaneously with the B.Tech. programme.
- 4.1.4 Students may be permitted to continue Minor programme, even if there are backlog subjects either in regular B.Tech programme, (or) in Minor programme, after registration.
- 4.1.5 Students may opt for on-line courses (approved by the Institute) for minor programme.

4.2 Award of B.Tech. Degree with Honours

Honours is an additional credentials a student may earn if s/he opts for the extra 18 credits needed for this in her/his own discipline. The concerned department specifies the set of courses for earning Honours. Honours is not indicative of class. Students can accumulate credits by registering for Honours courses prescribed by the department in advanced areas / research oriented subjects.

On successful accumulation of 18 credits at the end of the programme, this will be mentioned in the Degree Certificate e.g., "*Bachelor of Technology in Mechanical Engineering with Honours or Bachelor of Technology in Mechanical Engineering with Honours in Thermal Engineering.*" This will also be reflected in the Grade sheet, along with the list of courses taken.

For the award of the Honours to B.Tech., students, all requirements towards the basic degree and the Honours have to be completed within the stipulated period of the programme.

A student shall be eligible for the award of the B.Tech. degree with Honours upon satisfying the following requirements:

4.2.1 May register before commencement of III-I Semester of the B.Tech degree and Class work commences from III-I semester only
4.2.2 Registration for the Honours programme shall be optional.
4.2.3 Successfully complete an additional 18 credits prescribed for the Honours programme, simultaneously with the B.Tech. programme.
4.2.4 Student having a CGPA of 7.50 till II year – I Semester, is eligible to register
4.2.5 Students may opt for on-line advanced / research-oriented courses (if approved by the Institute) for Honours' programme.

Note:
Students shall continue the Minor and / or Honours, even if the student has backlogs after registration of the Minor (or) Honours programme. However, student has to complete the courses in line with B.Tech programme, admitted.

No additional fee is to be collected for Minor and / or Honours programmes by the Institution.

4.3 More than one Minor / Honours for students

Students can opt for earning additional minor/s (i.e. Honour and a minor, OR if time table permits, two minors). Students should discuss this with their faculty mentors since completing more than one minor / Honours would involve significant overload.

5. Structure of the Undergraduate Programme
The total course structure for B.Tech. Degree Programme typically consists of the following components:

a) Basic Science Courses (BSC)
b) Humanities and Social Sciences including Management Courses (HSC)
c) Engineering Science Courses (ESC)
d) Professional Core Courses (PCC)
e) Professional Elective Courses (PEC)
f) Interdisciplinary Open Electives Courses (OEC)
g) Mandatory Non-Credit courses (MNC)
h) Project / Mini Project / Community Service Project / Industry internships

Note:

i) Open Elective Courses can be in any of the following areas:
   a. Basic Sciences
   b. Engineering Science Courses
   c. Humanities, Social Sciences and Management
   d. Any approved course as approved by the Institute

ii) A student will not be permitted to register open elective course offered by the parent department.

The following table presents the distribution of credits by category wise.

Table.1. Allotment of courses in each category by AICTE and JNTUK

S. No	Category	AICTE	%	JNTUK	%
1	Humanities and Social Sciences including Management Courses	06	3-4%	06-09	3-6%
2	Basic Science Courses	24	14-15%	21-24	12-15%
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/ computer etc.	20	12-13%	21-24	12-15%
4	Professional core courses	58	35-36%	57-60	34-37%
5	Professional Electives & Industry oriented courses	26	15-16%	24-27	15-16%
6	Multidisciplinary Open Electives Courses	12	7-8%	09-12	6-7%
7	Project work and internship in industry or appropriate workplace/ academic and research institutions in India/abroad	16	9-10%	16	10%
8.	Indian Knowledge System	02	1-2%	0	0%
9.	Non-credit Mandatory course (includes Indian Knowledge System)	0	0	0	0%
		164		164	

6. Broad classification of various subjects

Table: 2 Broad Classification of Subjects

S. No.	Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PCC)	Includes subjects related to the parent branch of Engineering

3.	Elective Courses	Professional Elective Courses (PEC)	Includes elective subjects related to the parent branch of Engineering
		Open Elective Courses (OEC)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent branch of Engineering
		Industry oriented courses	Interdisciplinary / job-oriented / domain courses which are relevant to the industry
4.	Project and Internships	Project	Project / Industry oriented Full Semester Internship (VIII semester)
		Summer Internship	Summer Internships – Industry Internship / Mini Project / Community Service Project (between II year and III Year and also between III year and IV year)
5.	Mandatory Courses	Non-credit courses	Covering with society relevance, viz., Universal Human Values, Environmental Science, Constitution of India, Indian Knowledge System, Research Methodology & Intellectual Property Rights.

6.1 Programme Pattern

a. The B.Tech. (Regular) programme shall have duration of four academic years, having eight semesters (Two semesters for each academic year, Autumn and Spring semesters).
b. A mandatory three-week Student Induction Programme shall be conducted before the commencement of the first semester, as per AICTE guidelines mentioned in Table, covering physical activities, creative arts, Universal Human Values, literary and proficiency modules, expert lectures, local visits, departmental orientation, innovation, and related activities.
c. The curriculum provides enhanced flexibility through maximum of Professional Electives and Open and Industry oriented courses
d. Professional Electives enable specialization within the chosen discipline, while Open Electives promote interdisciplinary learning. Students shall avoid selecting electives with substantially overlapping course content.
e. Industry oriented Courses shall be offered, comprising multiple domain / interdisciplinary courses aligned with industry requirements and one course in Soft skills.

f. Students shall complete mandatory Community Service Project / internships / mini projects of at least six to eight weeks each at the end of the second and third years.
g. The final semester shall include a full-time industry internship / project work, in addition to open electives.
h. Students with a good academic record satisfying the Institute norms may pursue Minor or Honours programmes as per the regulations.

i. Institutions shall facilitate the use of Virtual Labs (https://www.vlab.co.in) to supplement laboratory learning through remote experimentation, as per the acceptance of the Institute authorities, for specialized subjects. However, all the laboratories must be available physically for Core laboratory courses in the Institution.
j. Each student shall be assigned a Faculty Advisor to provide guidance on course registration,

MOOCS, academic progress, career planning, placements, higher studies, GATE, and other competitive examinations.

7. Role of The Faculty Advisor

The students are expected to consult the Faculty Advisor on any matter relating to their academic performance and the courses they may take in various semesters. The Faculty Advisor guides the students to complete their courses of study for the required degree. For effective utilization of the opportunities for additional academic accomplishments, the planning of an individual's academic journey needs careful consideration, and hence constant consultation with the Faculty Advisors are imperative. The Faculty Advisor is the person whom the parents/ guardians should contact for performance related issues of their wards.

The role of the Faculty Advisor is outlined below:

a) Guide the students about the rules and regulations governing the courses of study.
b) Advise the students to register for courses as per the curriculum and their academic standing.
c) Approve the registration of the students.
d) Pay special attention to weak students and carefully monitor the performance of students recommended for the slow track option.
e) Advise students on Course Adjustment / Drop during the Semester within the stipulated time frame given in the Academic calendar.
f) Advise students seeking a semester drop about rules and regulations laid down for this purpose and recommend these cases to the college, for consideration
g) Registration of MOOC courses etc.

8. Registration

Registration at the beginning of each semester, as per the prescribed dates announced in the Academic Calendar, is mandatory for every student till s/he completes her/ his programme. Students are not permitted to re-register for course/(s), which they have already passed. All students' registration has to be approved by Faculty Advisor / HoD / Vice-Principal. Some courses may also require instructor consent.
If the student does not register for maximum of three semesters continuously without the consent of the institution, then the student admission, gets cancelled.

8.1 Semester-Wise registration

The student can register for courses s/he intends to take during a given semester on the basis of the programme for each discipline as given in the Curriculum and as per the advice given by the

respective Faculty Advisor. The Faculty Advisor is expected to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which s/he can register during the semester within the framework of the guidelines as approved by the Senate. The Faculty Advisor may advise the student to drop one or more courses/ activities based on his/her academic performance in MOOCs.

8.2 Procedure for Registrations

Every college has to maintain a system for online registration and the registration is normally done on the first two days of each semester. The registration schedule is announced in the Academic Calendar. In all circumstances, registration must be completed on or before the prescribed last date for registration.

8.2.1 Late Registration

Only for valid reasons, late registration may be permitted till the date specified in the Academic Calendar, on payment of a late registration fee.

8.2.2 Registration for the first two semesters

In each of the first two semesters, courses common to all branches are generally offered. A student is normally required to register for all the courses listed in the curriculum for these two semesters.

8.2.3 Registration for third and subsequent semesters

The prescribed credits per semester are given in the course structure of the respective programme. From the third semester onwards, registration is dependent on the academic standing of the student. A student may register for additional courses over and above the prescribed credits in the course structure with the approval of Faculty Advisor.

8.3 Registration for Open Elective Courses:

Open Elective course can be any credit course across the Institute provided that:

a) It should not be from the Academic discipline in which the student is admitted.
b) It should not be 'Core' or 'Professional Elective' course in the curriculum on the programme in which the student is registered.
An Open Elective course should be registered in consultation of Faculty Advisor.

8.4 Registration for Mandatory Non-credit Courses

Non-credit requirements are assessed as Satisfactory / Un-Satisfactory subject to the fulfilment of the minimum requirements of these activities and a minimum attendance. These courses are mandatory requirement for the award of degree. Students are expected to complete these requirements as per the schedule.

8.5 Registration for Additional Courses (Minor, Honours etc.)

Any student may register for minor or Honours courses subject to satisfying the pre-requisites for the respective courses. The number of students permitted for Minor courses is to be specified before the registration date by the department, and the allocation is done on the basis of CGPA. Students are permitted to register for Minor courses only during the pre- registration period.

8.6 Registration for Projects

Registration for B.Tech. Projects: Registration for B.Tech. Projects as specified in the curriculum, is similar to that for any other course. The details of allotment of topics, faculty supervisors etc. are specified by the concerned department before the commencement of the semester.

8.7 Minimum Number of Students Required to run a Particular Course

A minimum of 25% students should be registered in a course to be run as an Elective course. If less than 25% students are registered, Head of the department / Faculty Advisor may advise the students to choose other courses offered or MOOCs courses as approved by the Institute.

9. Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) Evaluation process

The performance of a student in each semester shall be evaluated course wise with a maximum of 100 marks for each theory / practical course. Summer Internships / mini projects shall be evaluated for 100 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks. However, mandatory courses with no credits shall be evaluated for 100 marks with Continuous internal evaluation only.

A student has to secure not less than 35% of marks in the end semester examination and

minimum 40% of marks in the sum total of internal and end semester examination marks to earn the credits allotted to each course.

Malpractices cases during examination process, will be governed by Institute examination section, as decided by the committee of experts. The details are presented in Annexure also. The autonomous institutions are advised to follow the same norms prescribed by the Institute with necessary approval from their Academic council.

9.1 Distribution of Marks for CIE and SEE:

Table 3. Maximum marks for CIE and SEE

Assessment Method	Theory courses (Marks)	Lab courses (Marks)
Continuous Internal Assessment (CIE)	40	50
Semester End Examination (SEE)	60	50
Total	**100**	**100**

9.1.1 For theory courses, the evaluation shall consist of 40 marks for Continuous Internal Evaluation (CIE) and 60 marks for the Semester-End Examination (SEE), as prescribed in the curriculum.

9.1.2 Practical / Laboratory courses, the evaluation shall consist of 50 marks for CIE and 50 marks for the Semester End Examination (PEE). The evaluation process should be designed to ensure that every student performs and completes all the laboratory experiments/exercises prescribed in the curriculum.

9.1.3 For courses involving two disciplines/branches, the syllabus shall be divided into Part-A and Part-B, each comprising three units. Continuous Internal Assessment shall be 20 marks for each discipline, totaling 40 marks for both discipline. The Semester-End Examination question paper shall also be divided into two parts carrying 30 marks each, as applicable.

9.2 Continuous Internal Evaluation (CIE)

For theory courses, the CIE will be as follows:

a. Five quiz tests (one for each unit) (comprising of 10 / 05 short answer questions of one / two marks each respectively) / assignments / presentation / case studies / mini project are to be conducted totaling 50 marks.

b. Two mid-semester examinations (subjective) shall be conducted during the semester. First Mid based on first 50% of the syllabus, second mid based on remaining 50% of the syllabus. Each mid examination consists of five descriptive / subjective questions carrying 5 marks each totaling 25 marks. The duration of the mid semester examination is 90 minutes. Total of two mid examinations is 50 marks.

c. The total marks obtained in (a) and (b) are scaled down to 40%.

Note:

- If a student is absent for a mid-semester examination, no re-examination shall be conducted, and zero marks shall be awarded for that mid-semester examination.

9.3 Semester End Examination (SEE)

The semester end examinations will be for 60 marks consist of Part-A and Part-B. Part-A contains FIVE / TEN small questions covering entire syllabus for 10 Marks. Part-B contains FIVE questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student shall answer either of the two questions. The duration of the examination is 180 minutes.

9.3.1 Practical Courses / Engineering drawing / Design classes

a) Continuous Internal Evaluation is considered for Practical courses as follows
b) For practical courses, there shall be a continuous evaluation during the semester for 50 sessional marks and end semester examination shall be for 50 marks.

9.3.2 Internal Evaluation (Laboratory / Engineering Drawing/ Design Classes)

1. For each experiment: 10 marks (Lab work, Design, Procedure, Viva-voce & record)

ii. Evaluated for best 10 experiments out of total experiments totaling to 100 marks. Total marks are scaled down to 50 marks.

9.3.3 Semester End Examination Evaluation (Laboratory / Engineering Drawing / Design classes)

i. The Semester End Examination shall be evaluated for 50 marks.

ii. The semester end examination evaluation pattern to be followed by the examiners should be as Follows: a) Procedure: 15 marks, b) Experimental work & Results: 25 marks, c) Viva voce: 10 marks.

iii. There shall be **no external examination for mandatory courses** with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, the re-examination shall be conducted for failed candidates, within the permissible duration of the programme.

iv. The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the Institute norms and shall be produced to the Committees of the Institute as and when the same are asked for (To be shifted to Guidelines for Affiliated and Autonomous Colleges).

10 Professional Elective Courses (PEC):

i) Professional Elective Courses include industry oriented and skill enhanced courses
ii) Students may opt to complete either the PEC offered by the college or an equivalent certificate course offered by NPTEL / SWAYAM Plus, industries, professional bodies, or other accredited agencies, as permitted by the Institute.
iii) The list of approved external certificate courses and the corresponding credit/grade conversion methodology shall be approved by the Institute before the commencement of the semester.
iv) Students enrolled in an approved external certificate course shall be exempted from attending the corresponding PEC and OEC. Attendance for mandatory requirements shall be computed excluding that course, subject to submission of a valid completion certificate which shall be verified by the Institute authorities through concerned platform.
v) Internal and/or external marks awarded through approved external agencies shall be scaled, wherever necessary, in accordance with Institute regulations. Credits shall be awarded only if the student secures the prescribed minimum qualifying marks after scaling.
vi) The certification of the approved online course completed by the student shall be verified by the Institute through concerned online platform.

11 Open Elective Courses

National Education Policy 2020 advises to improve the overall personality of the students joining in Higher Education. Thereby, in addition to **regular 3 credit courses,** it is considered to include '1 or 2' credit courses to encourage the hobbies and leadership qualities.

These credits for these Courses shall be obtained through **SWAYAM / Institute approved on-line platforms** or off-line courses within the Institute. The courses suggested are as follows

1. Music
2. Musical Instruments
3. Vocal (Classical)
4. Photography
5. Painting and Drawing
6. Digital Marketing
7. Leadership
8. Office Automation
9. Web Designing & Development
10. Graphic Design and Animation
11. CAD and Multimedia
12. Financial Markets

- Any other courses as recommended by Institute / approved by Institute from time to time.

Courses of **4 / 8 / 12 weeks (or min of 30 / 60 hrs of duration)** offered by NPTEL / SWAYAM/ SWAYAM+/ Course Era / edX or any other Institutue approved platforms shall be considered.

The students shall opt Open Elective courses **offered by the other departments** only.

Note:

The student may obtain the required credits in advance i.e., before semester starts, and such credits shall be transferred in the semester, in which Open Elective is in course structure.

Student is having the option to complete '1' and '2' credit courses separately (or) s/he may complete '3' credit course in place of '1' and '2' credit courses, but with approval of Institute.

12 Massive Open Online Courses (MOOCs):

i. Every student shall successfully complete at least one Institute-approved MOOC for the award of the degree. MOOCs shall normally be permitted for Professional Electives, Open Electives, and Industry-Oriented Courses. Core courses shall not be offered through MOOCs unless specifically permitted by Institute in accordance with prevailing UGC/AICTE regulations.
ii. Students shall register for Institute-approved MOOCs of 4, 8, or 12 weeks' duration, or as prescribed by the offering agency, with prior approval of the concerned department. A Faculty Advisor nominated by the Head of the Department shall guide and monitor the student's progress.
iii. Credits shall be awarded only upon successful completion of the MOOC, submission/verification of the valid course completion certificate, and fulfilment of the Institute's credit-transfer requirements. Applicable registration, certification, or examination fees shall be borne by the student.
iv. Students who successfully complete the proctored examination conducted by an approved MOOC provider shall be eligible for credit transfer in accordance with the Institute's Credit transfer Policy. Upon approval, the transferred credits shall be accounted for towards the corresponding programme requirements.
v. Students may register for approved MOOCs up to one academic year in advance, subject to departmental approval. Since MOOCs involve continuous learning, assignments, quizzes, and examinations, they shall not be treated as supplementary courses/examinations. The credits shall be considered for the award of the degree only if all requirements are fulfilled on or before the completion of IV B.Tech. II Semester.
vi. Marks/grades awarded by the approved MOOC provider shall be converted / scaled, wherever necessary, as per the Institute's equivalence and credit-transfer norms. Credits shall be awarded only when the prescribed minimum qualifying grade/marks are secured.
vii. Students shall preferably register for MOOCs assessed through proctored examinations, particularly those offered through SWAYAM/NPTEL or other Institute-approved platforms.
viii. For MOOCs registered in the VIII Semester, the Institute may conduct the examination, wherever required, to facilitate timely declaration of results. Students may be permitted to

appear either in the Institute-conducted examination or the approved proctored examination of the online platform, subject to Institute norms.

ix. If a student fails the proctored examination of a MOOC registered in an earlier semester for an approved elective, the Institute may conduct a supplementary examination, subject to the availability and equivalence of the course syllabus.

x. Course completion certificates issued through SWAYAM, SWAYAM Plus, NPTEL, or other approved platforms shall be verified through the respective online platform, wherever feasible, before credit transfer.

xi. The credits transferable for approved MOOCs shall normally be as follows:

Duration of MOOC	Equivalent Credits
4 weeks or equivalent	1 Credit
8 weeks or equivalent	2 Credits
12 weeks or equivalent	3 Credits

Note: The equivalence of a MOOC course with the corresponding Institute course and the number of credits to be transferred shall be determined by the competent academic authority of the Institute.

xii. In accordance with applicable UGC/AICTE guidelines, the Institute may provide appropriate opportunities, including supplementary examinations wherever prescribed, to enable students who are unsuccessful in completing a mandatory MOOC to fulfil the required academic credits.

xiii. The Institute reserves the right to amend, modify, or update these guidelines from time to time in accordance with the regulations/guidelines issued by UGC, AICTE, SWAYAM, NPTEL, or any other competent statutory authority. The equivalence of courses (Courses vs. Credits) shall be decided by the Institute authorities.

13 Credit Transfer Policy

In accordance with NEP 2020 and applicable UGC/AICTE regulations, the Institute shall facilitate credit transfer for approved MOOCs and other recognized online learning platforms to promote flexible and blended learning.

a) In accordance with NEP 2020 and applicable UGC/AICTE regulations, credits earned through Institute-approved MOOCs may be transferred towards Professional Electives, Open Electives, Micro-Credentials, and Industry-Oriented Courses; only through proctored examination.

b) Professional Core, Basic Sciences, Humanities and Social Sciences, and Engineering Sciences courses shall ordinarily be completed through offline/on-campus instruction, unless otherwise approved by the Institute.

c) Credit transfer shall be permitted only for courses offered through SWAYAM, NPTEL, SWAYAM Plus, or other Institute-approved platforms, subject to course equivalence, successful completion, and prescribed assessment requirements.

d) Verified Course Completion/Proctored Examination Certificates and other prescribed

documents shall be submitted to the Institute Examination Branch for credit transfer.

e) The course equivalence, credit equivalence, grading, and maximum transferable credits shall be determined by the competent academic authority in accordance with Institute Regulations and applicable UGC/AICTE guidelines.

f) The concerned institution shall submit the following documents to the Institute Examination Branch:
   - List of students eligible for credit transfer, duly recommended by the concerned authority
   - Course Completion Certificates issued by the authorized MOOC provider
   - Student undertaking forms and any other documents prescribed by the Institute.

14 Academic Bank of Credits (ABC)

The Institute implements the Academic Bank of Credits (ABC) in accordance with NEP 2020 and applicable UGC regulations to promote curriculum flexibility, academic mobility, and multiple entries and exit opportunities.

The ABC framework facilitates:

1) Accumulation, transfer, and redemption of academic credits earned by students across recognized Higher Education Institutions (HEIs), subject to Institute norms.
2) Earning credits through approved MOOCs and other recognized digital learning platforms.
3) Multiple Exit and Entry through the accumulation and transfer of credits in the student's ABC account, as per applicable regulations.
4) Students who have completed approved courses at JNTUK and subsequently continue their UG programme at another recognized institution may transfer such credits, subject to the norms of the receiving institution and applicable Institute regulations.
5) Students seeking admission to JNTUK with credits earned from Centrally Funded Technical Institutions (CFTIs), other recognized HEIs, or institutions specifically approved by the Institute may have such credits considered for transfer, subject to credit equivalence, academic requirements, and Institute norms.
6) The award of certificates, diplomas, degrees, or other academic credentials shall be based on the prescribed credit requirements and applicable Institute regulations.

All credit transfer, equivalence, acceptance, and redemption shall be governed by the Institute Regulations and applicable UGC/AICTE guidelines in force from time to time.

15 Mandatory Internships

Summer Internships: Students shall complete two mandatory summer internships, each of **minimum six / eight week** duration, at the **end of the second and third years** through onsite or virtual mode.

i. The **Second-year & Third-Year** Internship shall be an Industry Internship undertaken in collaboration with industries, Government organizations, Public Sector Undertakings (PSUs), construction agencies, power projects, software companies, research and development organizations, or any other recognized organization relevant to the student's programme of study or specialization. Where an industry internship is not possible, the student may undertake a Mini Project of equivalent academic rigor, subject to the approval of the concerned department.

ii. Students shall register for internships as per the curriculum and follow the guidelines issued by the Institute for execution and evaluation.

iii. Summer Internship **evaluation** shall be conducted by a **Departmental Committee** based on the internship report and oral presentation. The report and presentation shall carry 50% weightage each and shall be **evaluated for 100 external marks.** No internal marks shall be awarded. A certificate of successful completion from the host organization shall be enclosed with the report. A **minimum of 40% marks** is required for successful completion. Failed students shall repeat the internship as per Institute regulations.

15.1 Internship / Project Work

i. In the final semester, students shall undergo a full-semester onsite internship / a project with clearly defined objectives.

ii. Students shall submit an internship completion certificate / project report at the end of the semester. The project report may also be based on the work carried out during the internship.

iii. The project work shall carry 200 marks, comprising:
Internal Evaluation: 120 marks
External Evaluation: 80 marks

iv. Internal evaluation shall include:
Supervisor evaluation: 60 marks (Report: 30 marks, Seminar: 30 marks)
Departmental Project Review Committee evaluation: 60 marks (comprising the Supervisor, Senior Faculty Member, and Head of the Department)

v. All projects shall be showcased at the department level for review and knowledge sharing. External evaluation shall be conducted through a Viva-Voce Examination by an external examiner appointed by the Institute in the presence of the internal examiner.

vi. The institution shall facilitate, monitor, and ensure completion of all internship activities. Successful completion of internships is mandatory for the award of the degree. Students failing to complete the internship shall repeat and complete the same as per Institute guidelines.

vii. **Plagiarism content is permitted up to a maximum of 50%** using approved plagiarism software excluding their own contribution in research papers published in SCI / Scopus / approved journals of the Institute.

viii. **Patents awarded shall be considered as Project work.**

16 Attendance Requirements:

i. A student shall be eligible to appear for the Institute external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. 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 no case be condoned. Students who are admitted as in-patients for treatment are only eligible to claim condonation of attendance. Such students under medical exigencies need to Produce (a) Doctor Medical Prescription, (b) Medical bills duly signed by Doctor/Hospital authorities, (c) Diagnosis reports, if any, (d) Discharge

iii. summary issued at the time of discharge and any other supporting documents within two week(s) from the date of discharge to the respective institution.

iv. Institute at any point of time can inform the institution(s) to submit such list/proofs. Hence, respective institution shall verify and accord condonation privilege scrupulously. Students participation in Sports/Games and NSS activities shall also be permitted for condonation of attendance. In such cases, they need to produce (a) invitation letter from the organizing institute/agency, (ii) participation certificate and any supporting documents within two week(s) from the date of participation to the respective institution

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

vi. A stipulated fee of **INR 5,000/- per semester** shall be payable towards condonation of shortage of attendance **to the Institute.**

vii. A student can **avail condonation of attendance for a maximum of 3 times** during the study period.

viii. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class.

ix. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester in the subsequent academic year.

x. If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

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

17 Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements:

i. A student shall be promoted from first year to second year if he/she fulfils the minimum

attendance requirement as per Institute norms.

ii. A student will be promoted from II year 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 subjects that have been studied up to II Year I Semester (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 subjects that have been studied up to III Year I Semester (V semester).

iv. 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 III year I Semester (V semester) or IV Year I Semester (VII semester) respectively as the case may be.

v. 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.

18 Grading:

As a measure of the 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.

Table: 4 Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
≥ 90	S (Outstanding)	10
≥ 80 to < 90	A (Excellent)	9
≥ 70 to < 80	B (Very Good)	8
≥ 60 to < 70	C (Good)	7
≥ 50 to < 60	D (Average)	6
≥ 40 to < 50	E (Satisfactory)	5
< 40	U (Unsatisfactory)	3
Absent	Ab (Absent)	0

i) A student, who does not clear the end semester examination shall be awarded "U" grade. A student

obtaining Grade 'U' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered as supplementary examination.

ii) Grade U: When a student gets the U grade (transitory grade) in any course during a semester, the SGPA and the CGPA from that semester onwards will be tentatively calculated, taking 'three points' for each 'U' grade, consistent with the grade points shown in the structure of the grading table above. After the 'U' grade has to be substituted by better grades during a subsequent supplementary examination, the SGPA and CGPA of all the semesters starting from the earliest semester in which the 'U' grade has to be up dated, will be recomputed and recorded to take this change of grade into account. This grade can't be considered for promotion purpose.

iii) Grade Ab: The student gets zero grade points, if he is absent for the examination. If he attends subsequent supplementary examinations, the grade points shall be changed according to his performance.

iv) 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.

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 points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\text{SGPA} = \frac{\sum C_i X G_i}{\sum C_i}$$

Where, C_i is the number of credits of the ith subject and G_i is the grade points scored by the student in the ith course. The calculation of SGPA shall be up to a maximum of three decimal points. However, if the 4th decimal point is more than or equal to '5' then SGPA should be rounded of in third decimal point.

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

$$\text{CGPA} = \frac{\sum C_i X S_i}{\sum C_i}$$

Where, "S_i" is the SGPA of the ith semester and C_i is the total number of credits up to that semester.

The calculation of CGPA shall be up to a maximum of three decimal points. However, if the 4th decimal
point is more than or equal to '5' then SGPA should be rounded of in third decimal point.

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, E and U.

Award of Class:
After the student has satisfied 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:

Table: 5 Award of Class for different CGPA

Class Awarded	CGPA Secured
First Class with Distinction *(without backlog history)#*	$\geq 8.0^{\#}$
First Class	≥ 6.5 to <8.0
Second Class	≥ 5.5 to < 6.5
Pass Class	≥ 5.0 to < 5.5

CGPA to Percentage Conversion Formula: (CGPA – 0.5) x 10

 # (If the student is having backlog history due to any reasons, even if he/she get CGPA ≥8.0, such students will be awarded First class only)

19 Withholding of Results

If the candidate has any dues not paid to the Institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall **be withheld** in such cases. If any affiliated / constituent institution is involved in indiscipline activity, such institution results shall be withheld. The Institute shall resolve such problems, only after recommendations of the constituted committee within the framework of rules and regulations of the Institue.

20 Multiple Exit and Entry Option

(a) Exit Policy:

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

i) **Certificate in (Field of study / discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, credits of first year, followed by an additional credits of at least 6-credit job-specific internship/ apprenticeship that would help the candidates

acquire job-ready competencies required to enter the workforce. However, it should be approved by Institute authorities.

ii) **Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, credits of first and second years, followed by an additional credits of at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce. However, it is to be approved by Institute authorities.

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, i.e., credits obtained in six semesters.
Guidelines for 6 credit job specific internship are to be included here.

(b) Entry Policy:

a) Entry policy shall be presented only for the students admitted in 2026-27 (207-28 for lateral entry students). Students who are re-admitted in a particular year, either in 2nd, 3rd, and 4th years have to follow the regulations of the year of readmission.
b) The credits obtained so far will be considered as per the Academic Bank of Credit policy, and the rest of the credits should be obtained as per the regulations prevailing to continue the degree. In subsequent years, the subjects which were studied should not be repeated.
c) Institute is final authority to provide the guidelines at the time of re-entry. Such an entry policy shall be limited to maximum of two times.

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

21 Gap Year Concept:

a) The Gap Year concept for Student Entrepreneurs-in-Residence is introduced to encourage entrepreneurship among students. Outstanding students interested in pursuing entrepreneurship or establishing start-ups may be permitted to take a break of one year at any time after completion of the second year to undertake full-time entrepreneurial activities.
b) The gap period may be extended up to a maximum of two years and shall also be counted towards the maximum duration permitted for the completion of the degree.
c) Students seeking a gap year shall submit a proposal through the Principal of the respective college to the Institute. An Evaluation Committee constituted by the Institute shall review the proposal and decide the eligibility and approval for availing the Gap Year facility.

22 Transitory Regulations

a) Discontinued, detained, or failed students shall be eligible for readmission into the appropriate semester when it is offered, as per the regulations at the time of re-joining / re-admission.

b) Students detained due to shortage of attendance, non-fulfilment of academic requirements, or those who have failed after pursuing courses under earlier regulations, and students who discontinued their studies and wish to resume, shall be permitted to join the unfinished semester from the date of commencement of class work with the same or equivalent courses, as prescribed by the Institute.
c) Students permitted to avail the Gap Year facility shall be eligible to re-join the succeeding year of the B.Tech. Programme from the date of commencement of class work, subject to Institute regulations.

23 Minimum Instruction period for a Semester:

The minimum instruction period for each semester shall be for 16 weeks (excluding mid and end examination). However, the quiz and assignments shall be conducted in zeroth hour.

24 Medium of Instruction:

The medium of instruction is English / Telugu or any other language as approved by the Institute authorities or as prescribed by APSCHE and AICTE.

25 Transfer policy of the students:

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

26 Additional Credits

a) If the student is completing additional credits, i.e., more than 164 credits, the Institute gives another certificate for the additional credits obtained as per the Institute norms.
b) If the student register for B.Tech (Minor) or B.Tech (Hons) programme, but not able to obtain all the credits required as per the Institute norms, then the certificate may be given to the additional credits obtained as per the Institute norms.
c) If the student is involved in industry sponsored projects, research projects, software development services, or in any other academic contributions, then the student may please be rewarded accordingly, from the internal resources, if possible. Such projects may be considered as equivalent to summer internships subject to the approval of institution.
d) If the student obtains the credit/s through SWAYAM / NPTEL /SWAYAM (as prescribed by UGC /AICTE / or any other Government organization / Institute), more than the required credits through proctored examination / any other examination process acceptable to Institute, then the Institute may please transfer such credits to the Institute, if BoS approves such courses. If these credits are more than the required credits, then an additional certificate is given.

e) The credits of the courses of B.Tech (Minor) & B.Tech (Hons) should be obtained in the duration of B.Tech programme only. No extension of duration shall be given.

f) In the Multiple Exit and Multiple entry, if the student exists in either of the four years, the credits will be considered in Academic Bank of Credits. If the student re-joins with new regulations to obtain the credits required for the award of Degree in new regulations, any additional credits obtained by the students should be considered for the award of certificate accordingly.

27 Provisions for Differently abled Students:

Students with differently disabled in different categories should be given additional provisions in order to encourage them on par with other students, as per the AICTE / UGC Guidelines.

❖ **Different Categories with Persons with Benchmark Disabilities (PwBD)**

1. PwBD-1 : Blindness and low vision
2. PwBD-2 : Deaf and hard of hearing
3. PwBD-3 : Locomotor Disability (including cerebral palsy, muscular dystrophy, dwarfism, acid attack victims)
4. PwBD-4 : Autism, intellectual disabilities, mental illness, or specific learning Disabilities
5. PwBD-5 : Multiple disabilities from the above categories

a) In addition to the regular class work, these students may be given an opportunity to attend the extra classes, as per their requirements

b) Infrastructure facilities, viz., classrooms, restrooms, hostels, dining rooms, waiting rooms, transport within the campus, have to be provided as per the requirements.

c) Scribe is to be provided in both Internal examination and External examination, if the percentage of disability is more than or equal to 40%

d) Scribe should be from Intermediate (10+2) Arts students.

e) Separate room for attending the examination is to be provided

f) No relaxation shall be given for the internal and external examination pass marks

g) Extra time by another 20 minutes, for every one hour examination is to be provided, pro-rata basis, who are allowed to use scribe / reader / lab assistant.

h) All the candidates with benchmark disability not availing of scribe may be allowed additional time of minimum of one hour for the examination of 3 hours duration.

i) PwBD students must inform the Institute / institution in advance regarding their need for compensatory time.

j) A certificate from the competent Government medical doctor, is to be submitted to the Institute / Institution, as and when required to the concerned authorities

k) Any other facilities shall be given as per the rules and regulations of Government of Andhra Pradesh issued GO.

The above rules are applicable for both internal and external theory and laboratory examinations.

28 Special Leave

I. "Special leave" includes student's participating in Academic activities / extra-curricular activities approved by the Institute / Institute. The head of the academic unit shall be the approving authority on the recommendation of the faculty mentor / faculty incharge of the respective activity in which the student is participating.

II. **Special leave up to 5** working days (at a stretch or part) may be sanctioned by the head of Academic unit **excluding mid / end semester examination** in accordance with academic calendar. Compensation of any missed lab, quiz is to be provided by the respective faculty member

29 Planned break from studies

a) The student is allowed for maximum two semester break during his / her duration in continuation. This planned break can be for variety of reasons (ill-health, financial constraints, ill-health of parents, or other genuine reasons as approved by the Institute / Institute). The student has to apply for one or two semesters break with a course completion plan in consultation with competent authority.

b) A declaration must be submitted by the student with regard to consent / information of the parents as follows

   I. I have informed my parents and have their consent for semester (s) break
   II. I have informed my parents and do not have their consent for semester(s) break
   III. I have not informed my parents for semester break

c) The student should apply for semester break from his / her fourth semester onwards. The break will be allowed / approved after second year. Such approval can be availed by the student before fee payment (if any) and registration for a semester. Once the classes have started, the students will not be eligible to apply for a break for that semester.

d) Approval chain of such semester break-Head of the Department – Principal – Registrar – Concerned Director of Institute – Vice-Chancellor

e) The student would not be eligible for hostel / medical facilities during approved planned break.

f) Any reimbursement of fee from Government shall be stopped during the break period. Once, when he restores to his / her programme, the reimbursement of fee shall be decided by the Government authorities

g) In case of approved break, the period of break will be counted for the prescribed duration of the programme. Hence, the student will be eligible for the award of minor / Honours, if credits requirements are completed in the prescribed duration of the programme excluding approved break.

h) A letter will be issued to parents in case of approved break, on the address available in the records of the students.

i) However, **the maximum duration of completing the B.Tech degree is limited to 8 years.**

30 General Instructions:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices and Punishments are governed by the Institute Examination Section, as approved by the Institute. (The details are appended in Annexure)
iii. Where the words "he", "him", "his", occur in the regulations, they also to be replaced as *he/she/him/her/his/hers* respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Institute is final. Institute is authorized to take any decisions in terms of regulations / rules, if they are not appropriately mentioned in this document.
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 Institute.

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ACADEMIC REGULATIONS (DR26)

FOR B.TECH. (LATERAL ENTRY SCHEME)

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

1. **Award of the Degree**

(a) Award of the B.Tech. Degree if he/she fulfils the following [credit and duration figures below are as per the lateral entry scheme: the underlying eligibility rule is otherwise the same as Section 1(a) of the main B. Tech Academic regulations]

(i) Pursues a course of study for not less than three academic years and not more than six academic years.

(ii) Registers for 122 credits and secures all 122 credits.

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

(i) Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 122 credits.

(ii) Registering for Minors is optional.

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

(iv) All other guidelines are same as regular students of B.Tech programme

(c) Award of B.Tech. degree with Honours if he/she fulfils the following:

(i) Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 122 credits.

(ii) Registering for Honours is optional.

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

(iv) All other guidelines are same as regular students of 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. **Minimum Academic Requirements**

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

[This promotion rule corresponds to the main academic regulations – the single promotion check point applicable to lateral entry students, who joined directly in II year]

i. The students of lateral entry shall have the attendance requirements to be satisfied for the promotion from II year to III year. However, the lateral entry student shall be promoted from III year to IV year, only if the student satisfies 40% of the credits till III year – I semester (V semester).

ii. And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

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 regulations as applicable for B. Tech. Four-year degree course (Regular) will continue for B. Tech. (Lateral Entry Scheme).

Guidelines Minor Programme

(Applicable from the Academic Year 2026-27(DR26))

1. Objectives

The objectives of introducing the Minor programme are to:

a) Provide interdisciplinary / multidisciplinary learning opportunities to undergraduate students.

b) Enhance employability by developing additional domain expertise.

c) Enable students to acquire professional skills beyond their major discipline.

d) Facilitate specialization in emerging engineering domains.

2. Eligibility and Applicability

2.1 B.Tech. students (Regular and Lateral Entry) may register for a Minor programme from the II Year I Semester (**III semester) onwards** in any approved discipline other than their parent branch.

2.2 Students shall not be permitted to pursue a Minor offered by the same discipline.

2.3 Students who have completed the B.Tech. degree, and discontinued the programme, shall not be eligible to register/continue the Minor programme.

2.4 Award of Minor is conditional upon successful completion of the regular B.Tech. programme. Minor shall not be awarded independently.

3. Minor Programme Structure and Credit Requirements

3.1 A student shall earn **18 additional credits** from the selected Minor discipline for the award of Minor.

3.2 The required credits shall be completed through:

3.2.1 Six theory courses of 3 credits each; **or**

3.2.2 Five theory courses of 3 credits each and two laboratory courses of 1.5 credits each;

or

3.2.3 Four theory courses of 3 credits each and four laboratory courses of 1.5 credits each

3.3 Minor courses may be completed through:

3.3.1 Offline courses offered by the institution; or

3.3.2 Approved online learning platforms such as NPTEL, SWAYAM, SWAYAM Plus, or other Institute-approved platforms.

3.4 Students may select theory and/or laboratory courses from the approved Minor curriculum.

3.5 Courses from the parent department shall not be considered for fulfilling Minor credit requirements.

3.6 The curriculum and syllabus of Minor courses shall be approved by the concerned Board of Studies (BoS).

3.7 The student is permitted to acquire the required credits by completing the BoS suggested courses through ONLINE platforms viz., NPTEL / SWAYAM / SWAYAM Plus, and Institute approved online courses by completing the proctored examination

4. Online Learning and Credit Transfer

4.1 Students may earn Minor credits through approved online courses of through NPTEL/SWAYAM/SWAYAM Plus or other approved Industry (TCS/L&T/IBM etc) platforms. Credits equivalency shall be decided from time to time as per Institute norms.

4.2 Students shall submit valid course completion certificates issued by the authorized platform for credit recognition.

4.3 Assessment and certification of online courses shall be governed by the norms of the respective platform.

5. Attendance Requirements

5.1 Attendance for Major and Minor courses shall be calculated separately.

5.2 A minimum of **75% attendance** in Minor courses is mandatory for appearing in semester end examinations.

5.3 Attendance condonation between **65% and 75%** may be permitted as per Institute regulations.

5.4 Students with attendance below **65%** in Minor courses shall not be permitted to appear for semester-end examinations.

5.5 Students detained in the regular B.Tech. programme due to attendance shortage shall not be allowed to register for courses offered under Minor programme.

6. Admission and Registration Procedure

a) Departments offering Minor programmes shall notify available minor programmes and courses before the commencement of the academic session.

b) Interested students shall apply through the Head of their parent department.

c) The department offering the Minor shall publish the list of selected students based on the approved criteria.

d) The complete selection and registration process shall be completed before the commencement of the semester.

e) Selected students shall submit the joining request through the concerned Head of Department and register Minor courses with approval of the Principal.

f) Both the parent department and Minor offering department shall maintain records of students pursuing the Minor.

g) Any change or withdrawal of registered Minor courses shall be permitted within two weeks of registration with approval from the concerned authorities.

7. Seat Allocation

a) Minor courses shall be offered from disciplines approved by the Institute.
b) No additional fee shall be charged for offline Minor courses offered by the institution.

8. Teaching, Examination and Evaluation

a) Teaching, examination, and evaluation procedures for offline Minor courses shall be identical to those followed for regular B.Tech. courses.
b) Semester-end examinations for offline Minor courses shall be conducted along with regular B.Tech. examinations.
c) The additional credits earned through the minor programme shall appear in the separate Grade sheet, but, shall not contribute to the CGPA calculations of the B.Tech. programme. This grade sheet shall be issued along with final academic records.
d) Examination fee shall be as per Institute regulations.

9. Monitoring and Mentoring

a) The progress of students pursuing Minor programmes shall be monitored continuously as per Institute academic regulations.
b) A faculty mentor/advisor from the parent department shall be assigned to guide students regarding Minor course registration and completion.
c) Departments shall coordinate timetable preparation to avoid clashes between Major and Minor courses.

10. Award of Minor Degree

a) A student shall be awarded the Minor qualification only after:
    - Successful completion of the Regular B.Tech. programme; and
    - Completion of the prescribed 18 additional Minor credits.
b) The provisional / degree certificate shall indicate the Major degree along with the Minor specialization.
c) In order to award Minor degree, only obtained credits will be considered. However, the student shall complete the Minor in the stipulated period of time only.
d) The student shall complete the additional credits also as mentioned in the guidelines for minors
e) The award of the class is based on the CGPA obtained in the major degree requirement only. Separate grade sheet shall be issued for additional courses registered for Minor.

11. Fee for Minor Courses

- No additional fee shall be charged for registration of offline Minor courses offered by the respective institution. Examination fee shall be applicable as per Institute norms.

Guidelines for B.Tech Honours

(Applicable from the Academic Year 2026-2027 (DR26)

1. Introduction

The **B.Tech. Honours programme** enables academically meritorious students to gain advanced knowledge and specialization within their parent discipline. It is intended to encourage higher studies, research orientation, and advanced professional competency at the undergraduate level.

Students pursuing regular B.Tech programmes, who satisfy the prescribed eligibility criteria may opt for Honours by earning **additional 18 credits** beyond the regular B.Tech credit requirement. The additional courses shall comprise advanced theory, laboratory, and elective courses approved by the concerned Board of Studies (BoS).

2. Objectives

The objectives of introducing B.Tech Honours are to:

2.1 Encourage undergraduate students towards higher studies and research.
2.2 Develop advanced competency in the core engineering discipline.
2.3 Provide opportunities for specialization in emerging areas of the parent discipline
2.4 Enhance technical and professional skills beyond the regular curriculum.
2.5 Enable students to pursue advanced/postgraduate-level courses during undergraduate study.

3.Eligibility and Applicability

3.1 The programme is applicable to **B.Tech. Regular and Lateral Entry students** of Engineering and Technology programmes.
3.2 Students with a minimum **CGPA of 7.5 up to II Year I Semester (III semester)** are eligible to register for Honours.
3.3 Honours registration shall be permitted from the II Year II Semester (**IV semester) onwards**.
3.4 After registration of Honours, in IV semester, no restriction to maintain the CGPA in forth coming semesters
3.5 Both Regular B.Tech. and Honours programmes shall be completed within the stipulated duration.
3.6 Admission to Honours shall be based on CGPA obtained up to III semester.
3.7 Transfer of credits between Honours and Minor programmes or between Honours and other degree programmes shall not be permitted.

4 Honours Programme Eligibility and Registration Rules

4.1 Students shall pursue Honours only in their **parent branch/discipline**.

4.2 A student pursuing B.Tech. in a particular branch shall select Honours courses from the same discipline as approved by the BoS.

4.3 Students shall complete Honours within the prescribed duration of the regular B.Tech. programme Honours shall be awarded along with the regular B.Tech. degree.

4.4 The additional credits earned shall appear in the grade sheet but shall not contribute to CGPA calculation.

4.5 Honours courses shall not be considered equivalent to regular courses if the student fails to complete the B.Tech. programme.

4.6 Students who have already completed the degree shall not be eligible to register for Honours.

4.7 Students pursuing a **Minor programme** can register for B.Tech. Honours.

5 Structure and Credit Requirements

5.1 A student shall earn **18 additional credits** from the parent discipline for the award of B.Tech. Honours. The required credits shall be completed through:

5.1.1 Six theory courses of 3 credits each; **or**

5.1.2 Five theory courses of 3 credits each and two laboratory courses of 1.5 credits each; or

5.1.3 Four theory courses of 3 credits each and four laboratory courses of 1.5 credits each

5.2 Students shall complete all courses through offline, if the institution offers. Otherwise student is permitted to register to approved on-line platforms for a maximum of two courses as per the required credits. Number of Credits for on-line platforms shall change from time to time, as per the Institute norms.

5.3 Honours credits may be earned through:

5.3.1 Offline courses offered by the institution; or

5.3.2 Approved online courses through platforms such as NPTEL/SWAYAM/SWAYAM+ or other approved Industry (TCS/L&T/IBM, etc.) platforms.

5.3.3 Online courses shall be domain-specific, with a minimum duration of **12 weeks**, as approved by the Institute authorities.

5.3.4 The Honours curriculum and syllabus shall be approved by the concerned Board of Studies.

6 Attendance Requirements

6.1 A minimum of **75% attendance** in Honours courses is required to appear for semester-end examinations.

6.2 Attendance shortage between **65% and 75%** may be condoned as per Institute regulations.

6.3 Students with attendance below **65%** shall not be permitted to appear for Honours examinations.

7 Admission and Registration Procedure

7.1 The department offering Honours shall notify available specializations and courses before commencement of the semester.

7.2 Interested students shall submit applications through the concerned Head of Department.

7.3 The department shall publish the list of selected students based on eligibility criteria.

7.4 Selected students shall submit a joining request through the HOD to the Principal.

7.5 Students shall register Honours courses with approval of the Principal and guidance of the assigned mentor.

7.6 The department offering Honours shall maintain records of enrolled students.

7.7 Departments shall coordinate with the time table committee to avoid overlapping between regular and Honours courses.

7.8 Withdrawal or change of registered Honours courses shall be permitted within two weeks of registration with approval of concerned authorities.

8 Monitoring and Mentoring

8.1 The progress of students pursuing Honours shall be monitored continuously as per Institute academic practices.

8.2 A faculty advisor shall be assigned to guide and monitor students throughout the programme.

9 Teaching, Examination and Evaluation

9.1 Teaching, examination, and evaluation procedures for offline Honours courses shall be identical to regular B.Tech. courses.

9.2 Semester end examinations for Honours courses shall be conducted along with regular B.Tech. examinations.

9.3 Assessment and certification of online courses shall be as per the norms of the respective platforms.

9.4 Students shall submit valid completion certificates for online courses for credit recognition.

9.5 A separate grade sheet shall indicate Honours courses completed by the student.

9.6 Examination fee shall be as per Institute regulations.

10 Award of B.Tech. Honours Degree

A student shall be awarded the **B.Tech. Honours degree** upon:

10.1 Successful completion of the regular B.Tech. programme

10.2 Completion of additional 18 Honours credits

10.3 In order to award Honours degree, only obtained credits will be considered. However, the student shall complete the Honours in the stipulated period of time only.

10.4 Separate grade sheet shall be issued for courses registered under Honours

11 Fee for Honours Courses

No additional fee shall be charged for registration of offline Honours courses offered by the respective institution. Examination fee shall be applicable as per Institute norms.

B.TECH. - COURSE STRUCTURE – DR26

(Applicable from the academic year 2026-27and onwards)

Table: 6 Induction Programme

S. No.	Course Name	Category	L-T-P-C
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

Annexure-I

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, 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 Institute.

3.	Impersonates any other candidate in connection with the examination.	1. The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year.
		2.The candidate is also debarred for two consecutive semesters from class work and all Institute 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 Institute 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.

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. The candidates also are debarred and forfeit their seats. 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 the script or any part thereof 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 Institute 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 and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institute for further action and impose 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 malpractices)

   (i) A show cause notice shall be issued to the college.

   (ii) Impose a suitable fine on the college.

   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year before any institutional penalty under (i) - (iii) above is finalized.

* * * * *

DEPARTMENT OF MECHANICAL ENGINEERING

DR26 COURSE STRUCTURE

B. Tech. - I Year I Semester

S. No.	Category	Course Code	Title	L	T	P	Credits
1	BSC	A2610001	Linear Algebra and Calculus	3	0	0	3
2	BSC	A2610004	Engineering Physics	3	0	0	3
3	MNC	A2610005	Environmental Science	2	0	0	0
4	BSC	A2610010	Engineering Physics Lab	0	0	3	1.5
5	ESC	A2610015	Basic Electrical and Electronics Engineering	3	0	0	3
6	ESC	A2610018	Computational Thinking and Problem Solving using Python	3	0	0	3
7	ESC	A2610019	Computational Thinking and Problem Solving using Python Lab	0	0	3	1.5
8	ESC	A2610022	AI Tools and Applications	0	1	3	2.5
9	ESC	A2610204	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
10	ESC	A2610300	Engineering Graphics Lab	0	1	3	2.5
Total				**14**	**2**	**15**	**21.5**

B. Tech. I Year II Semester

S. No.	Category	Course Code	Title	L	T	P	Credits
1	HSM	A2620000	English for Technical Communication	3	0	0	3
2	BSC	A2620001	Differential Equations and Vector Calculus	3	0	0	3
3	MNC	A2620003	NSS / Community Service	0	0	2	0
4	HSM	A2620004	English for Technical Communication and MOODLES Lab	0	0	3	1.5
5	BSC	A2620010	Chemistry for Mechanical Engineers	3	0	0	3
6	BSC	A2620015	Chemistry for Mechanical Engineers Lab	0	0	3	1.5
7	ESC	A2620300	Engineering Mechanics	3	0	0	3
8	ESC	A2620301	Engineering Workshop Practice	0	0	3	1.5
9	ESC	A2620302	Engineering Mechanics Lab	0	0	3	1.5
10	ESC	A2620501	Design Thinking and Innovation	0	1	3	2.5
Total				**12**	**1**	**17**	**20.5**

CATEGORY **BSC**	**LINEAR ALGEBRA AND CALCULUS** **(Common to all Branches)**	**L**	**T**	**P**	**C**
COURSE CODE **A2610001**		**3**	**0**	**0**	**3**

Pre-requisite: Mathematics of 10+2 / Intermediate level (algebra, matrices and basic calculus)

Course Objectives:

- The main objective of this course is to provide the learner with variety of linear algebra techniques to solve linear systems, orthogonal representation of the quadratic surfaces and apply its knowledge in optimization problems.
- It aims further to calculate areas, surfaces and volumes in various coordinate systems

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Apply matrix techniques to find matrix properties, solve linear equations, and use numerical methods in engineering and scientific problems.	K3
CO2	Develop and use of matrix algebra techniques that are needed by engineers for practical applications	K4
CO3	Utilize mean value theorems for real life problems.	K3
CO4	Solve problems involving functions of several variables using partial differentiation, total derivatives, Taylor/ Maclaurin series, Jacobians, and optimization techniques including Lagrange multipliers.	K3
CO5	Apply double, triple integrals to solve problems involving their applications	K3

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

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

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT-I: MATRICES

Rank of a matrix by echelon form, normal form. Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT-II: EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION

Eigen values, Eigen vectors and their properties. Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation. Singular valued Decomposition.

UNIT-III: CALCULUS

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and

applications on the above theorems. Taylor's and Maclaurin series**.**

UNIT-IV: PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS)

Functions of several variables: Continuity and Differentiability, Partial derivatives, Total derivatives, Chain rule, Euler's Theorem, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, Maxima and Minima of functions of two variables without constraints and with Constraints-Method of Lagrange multipliers.

UNIT-V: MULTIPLE INTEGRALS

Double integrals, Change of order of integration, Triple integrals, Change of variables from Cartesian to polar, Cylindrical and Spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

LEARNING RESOURCES:

Text Books:

1. Grewal, B.S.(2024).HigherEngineeringMathematics,45thEdition.KhannaPublishers.
2. Kreyszig,E.(2025).AdvancedEngineeringMathematics,11thEdition.JohnWiley&Sons.

Reference Books:

1. Ramana,B.V.(2017).HigherEngineeringMathematics.McGrawHillEducation.
2. James, G.(2018).AdvancedModernEngineeringMathematics.5thEditionPearsonpublishers.

CATEGORY **BSC**	**ENGINEERING PHYSICS** (Common to CE and ME)	**L**	**T**	**P**	**C**
COURSE CODE **A2610004**		**3**	**0**	**0**	**3**

Pre-requisites: Nil

COURSE OBJECTIVES:

1. To equip students the concepts of interference, diffraction and polarization and their applications in optics and communication systems.
2. To introduce crystallography and X-ray diffraction methods for characterizing construction materials and studying crystal structures.
3. To provide a working knowledge of quantum mechanics and elementary quantum computing concepts relevant to sensing and secure monitoring systems.
4. To familiarize students with oscillations, vibration control, and building acoustics as applied to earthquake-resistant and smart structures.
5. To impart knowledge of ultrasonics and non-destructive testing methods used for quality inspection and defect detection in civil structures.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	**Analyze** the principles of interference, diffraction, and polarization and apply basic optical measurement techniques for engineering applications	**K4**
CO2	**Examine** crystal structures and material characterization by using x-ray diffraction method.	**K4**
CO3	**Apply** the concepts of quantum mechanics and elementary quantum computing to explain quantized systems and quantum-based communication ideas.	**K3**
CO4	**Analyze** oscillatory systems, vibration-control mechanisms, and architectural acoustics relevant to earthquake-resistant and acoustically optimized structures.	**K4**
CO5	**Evaluate** ultrasonic and non-destructive testing techniques for identifying defects and assessing the quality of structural materials.	**K5**

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT – I: APPLIED WAVE OPTICS

Interference: Superposition Principle – Coherence – Types of Interference – Thin-film interference (reflection geometry) – Newtons rings – Determination of wavelength and refractive index.

Diffraction and Optical Surveying: Fresnel and Fraunhofer diffraction – Fraunhofer's diffraction due to single slit, double slit & N-slits (qualitative) – Diffraction Grating and grating spectrum – Dispersive and Resolving power of a grating.

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

UNIT – II: CRYSTALLOGRAPHY AND MATERIAL CHARACTERIZATION

Crystallography: Space lattice – Basis – Unit cell – Lattice parameters – Crystal systems and Bravais, lattices, Coordination number and packing fraction of SC, BCC and FCC structures.

Material Characterization: Miller indices – Inter-planar spacing between successive (h k l) planes – Bragg's law – X-ray Diffractometer – Crystal structure determination by Laue's method.

UNIT – III: INTRODUCTION TO QUANTUM MECHANICS AND QUANTUM COMPUTING Quantum Mechanics: de Broglie concept of matter waves – Heisenberg's uncertainty principle – Wave function – Postulates of quantum mechanics – Schrödinger's time dependent and time-independent wave equations –Particle in a one-dimensional potential well – Quantum tunneling (basic idea).

Quantum Computing: Introduction to quantum computing – Classical bits vs qubits – superposition and entanglement – Basic quantum operations – Hadamard gate – Pauli-X gate – Idea of quantum measurement.

UNIT - IV: OSCILLATIONS & ACOUSTICS OF BUILDINGS

Oscillations: Oscillations of springs – Series and parallel combination of springs (quantitative) – Stiffness factor and its significance – Damping and resonance: over-, under- and critical damping (qualitative) – Forced oscillations and resonance – Sharpness of resonance – Quality factor (Q).

Acoustics of Buildings: Introduction – Requirements of acoustically good auditorium – Reverberation – Reverberation time – Sabine's formula (qualitative) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

UNIT – V: ULTRASONICS AND NON-DESTRUCTIVE TESTING

Ultrasonics: Introduction – Characteristics of ultrasonic waves – Production of ultrasonic waves by magnetostriction and piezoelectric methods – Detection - Acoustic grating – Applications.

Non-Destructive Testing (NDT): Introduction - pulse echo system through transmission and reflection modes – Applications.

LEARNING RESOURCES:

TEXTBOOKS:

1. Avadhanulu, M.N., Kshirsagar, P.G. & Murthy, T.V.S.A., A textbook of engineering physics, S. Chand Publishing (2019)
2. P.K. Palanisamy, Engineering physics. Scitech Publications (2015)

REFERENCE BOOKS:

1. Pandey, B. K., & Chaturvedi, S., Engineering physics, Cengage Learning (2021)
2. Bhattacharya, D. K., & Tandon, P., Engineering physics, Oxford University Press (2015)
3. Srinivasan, M. R., Engineering Physics, New Age International (2009)

WEB RESOURCES:

1. NPTEL. (n.d.). National Programme on Technology Enhanced Learning. https://nptel.ac.in
2. MIT OpenCourseWare. (n.d.). Physics courses. https://ocw.mit.edu
3. Georgia State University. (n.d.). HyperPhysics. http://hyperphysics.phy-astr.gsu.edu
4. PhET Interactive Simulations. (n.d.). University of Colorado Boulder. https://phet.colorado.edu
5. American Concrete Institute. (2021). ACI 228.2R: Nondestructive test methods for evaluation of concrete in structures. https://www.concrete.org

CATEGORY MNC	ENVIRONMENTAL SCIENCE	L	T	P	C
COURSE CODE: A2610005		2	0	0	0

Pre-requisites: Nil

Course Objectives:

1. To provide core foundational knowledge on natural resources, ecosystems, and their functional balances.
2. To understand the causes, effects, and mitigation strategies of various environmental pollutions.
3. To evaluate the socio-economic, ethical, and legal frameworks governing environmental protection.
4. To mainstream sustainable development, green engineering practices, and climate action into technical designs.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand the structure, function, and interdependence of ecosystems and natural resources for their sustainable utilization.	K2
CO2	Analyze the sources, effects, and control/mitigation measures of air, water, soil, and noise pollution.	K3
CO3	Evaluate the significance of biodiversity and assess threats to ecosystems along with applicable conservation strategies.	K4
CO4	Interpret environmental policies, legislation, and Environmental Impact Assessment (EIA) procedures relevant to engineering projects.	K4
CO5	Apply principles of sustainability, climate change science, and environmental ethics to engineering decision making and social responsibility.	K5

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	3	1	--	L	--	2			
CO2	2	3	2	2	2	3	1	1	2	--	2			
C03	1	2	1	1	1	3	2	1	2	--	2			
CO4	1	2	2	1	1	3	3	--	2	1	2			
CO5	1	2	3	1	2	3	3	2	3	1	3			
1- LOW, 2- MODERATE, 3- HIGH														

UNIT-I

Ecosystems and Natural Resources: Concept, structure, and function of an ecosystem; biotic and abiotic components; Energy flow, food chains, food webs, ecological pyramids;

Biogeochemical cycles: carbon, nitrogen, phosphorus, sulphur, hydrological cycle; Types of ecosystems: forest, grassland, desert, aquatic (pond, lake, estuarine);

Natural resources: forest, water, mineral, food, energy and land resources — use and over-exploitation; Renewable vs. non-renewable resources; concept of carrying capacity; Role of an individual/engineer in conservation of natural resources.

UNIT-II

Environmental Pollution and Control:

Air pollution: sources, classification of pollutants, effects, control equipment (ESP, scrubbers, cyclones).

Water pollution: point/non-point sources, water quality parameters (BOD, COD, DO), wastewater treatment overview.

Soil pollution: Causes (pesticides, industrial waste), degradation, remediation approaches.

Noise pollution: sources, measurement (dB), health effects, control measures.

Solid and hazardous waste management: 3R principle, e-waste, biomedical waste, landfill/incineration basics. Introduction to Air Quality Index (AQI) and Central/State Pollution Control Board monitoring framework.

UNIT-III

Biodiversity and Conservation: Levels and values of biodiversity (consumptive, productive, social, ethical, aesthetic); India as a mega-biodiversity nation; biodiversity hotspots; Threats to biodiversity: habitat fragmentation, poaching, human-wildlife conflict, invasive/alien species; In-situ conservation: national parks, wildlife sanctuaries, biosphere reserves; Ex-situ conservation: seed banks, botanical/zoological gardens, gene banks; IUCN Red List categories; endangered and endemic species of India.

UNIT-IV

Environmental Policy, Law, and Impact Assessment: Overview of Indian environmental legislation: Environment (Protection) Act 1986, Water Act 1974, Air Act 1981, Wildlife Protection Act 1972, Forest (Conservation) Act 1980.

Environmental Impact Assessment (EIA): concept, process, screening, scoping, public hearing, EMP Role of MoEFCC, CPCB/SPCB, and National Green Tribunal (NGT);

International agreements: Stockholm Conference, Rio Summit, Kyoto Protocol, Paris Agreement, SDGs (overview); Environmental clearance process for industrial/infrastructure projects; Engineer's professional and ethical responsibility in environmental compliance.

UNIT-V

Sustainability, Climate Change, and Global Environmental Issues: Concept of sustainable development; UN Sustainable Development Goals (SDGs) overview; Greenhouse effect, global warming, climate change causes and impacts Ozone layer depletion; acid rain; sea-level rise; Renewable energy sources: solar, wind, biomass, hydro — engineering relevance; Green building concepts, cleaner production, circular economy, carbon footprint/net-zero concepts; Environmental ethics, sustainable lifestyle, and role of engineers/technologists as change agents; Disaster management basics: natural and man-made disasters (overview).

Learning Resources:

Text Books:

1. Bharucha, E. — Textbook of Environmental Studies for Undergraduate Courses, Universities Press.
2. Rajagopalan, R. — Environmental Studies: From Crisis to Cure, Oxford University Press.

Reference Books:

1. Kaushik, A. & Kaushik, C.P. — Perspectives in Environmental Studies, New Age International Publishers.
2. Miller, G.T. & Spoolman, S. — Environmental Science, Cengage Learning.

Web Resources:

1. Central Pollution Control Board (CPCB) — Official reports, AQI Bulletins, and standards (cpcb.nic.in)
2. Ministry of Environment, Forest and Climate Change (MoEFCC) — EIA Notification and policy documents (moefcc.gov.in)
3. UNEP / IPCC Assessment Reports — climate change and sustainability data (unep.org, ipcc.ch)
4. NPTEL/SWAYAM course: "Environmental Studies" — for supplementary video lectures

CATEGORY **BSC**	**ENGINEERING PHYSICS LAB** (Common to CE and ME)	**L**	**T**	**P**	**C**
COURSE CODE **A2610010**		**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES:

- To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	**Apply** optical phenomena such as interference and diffraction to determine key parameters including the radius of curvature of lenses and wavelengths of monochromatic light sources.	**K3**
CO2	**Evaluate** the electrical and dielectric properties of materials, including dielectric constants and temperature-dependent resistance of thermistors.	**K5**
CO3	**Analyze** solid-state semiconductor devices and magnetic materials to estimate energy bandgaps and analyze magnetic hysteresis (B-H curves).	**K4**
CO4	**Investigate** electromagnetic fields and current-field interactions, specifically measuring magnetic field distributions along the axis of circular coils.	**K4**
CO5	**Apply** principles of wave dynamics, acoustics and simple harmonic motion to evaluate mechanical oscillations, determine gravitational acceleration, verify laws of stretched strings and measure frequencies using compound pendulums, Sonometers and Melde's apparatus.	**K3**

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	1	-	-	-	-
CO2	3	2	-	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	-	-	-	-	-	1	-	-	-	-
CO4	3	2	-	-	-	-	-	-	1	-	-	-	-
CO5	3	2	-	-	-	-	-	-	1	-	-	-	-

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

LIST OF EXPERIMENTS

(Any 10 of the following listed experiments)
(Out of which any **TWO** experiments may be conducted in virtual mode)

1. Determination of thickness of thin object by wedge method.
2. Determination of radius of curvature of a given plano convex lens by forming Newton's rings.
3. Determination of wavelength of Laser and grating element.
4. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
5. Determination of resolving power of telescope.
6. Verification of Brewster's law.

7. Determination of dielectric constant of given capacitor by charging and discharging method.
8. Determination of temperature coefficients of a thermistor.
9. Determination of the energy gap of a semiconductor using p-n junction diode.
10. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
11. Determination of the Resistivity of semiconductor by four probe method.
12. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
13. Estimation of Planck's constant using photoelectric effect.
14. Study the variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
15. Sonometer: Verification of laws of stretched string.
16. Determination of frequency of electrically maintained tuning fork by Melde's apparatus.
17. Determination of Acceleration due to gravity and Radius of gyration using Compound pendulum.
18. Determination of magnetic susceptibility by Kundt's tube method

LEARNING RESOURCES:

REFERENCES:

1. S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics"S Chand Publishers, 2017.

WEB RESOURCES:

- V-Lab: vlab.co.in

CATEGORY ESC	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to CE and ME)	L	T	P	C
Course Code: A2610015		3	0	0	3

Pre-requisites: Nil

Course Objectives:

1. To introduce the fundamental laws, circuit elements, and network theorems used in the analysis of DC electrical circuits.
2. To develop an understanding of single-phase AC circuits using phasor concepts, impedance, and power calculations, and the basic concepts of three-phase systems.
3. To explain the construction, operating principles, basic equations, characteristics, and applications of DC and AC machines.
4. To familiarise students with semiconductor devices and basic electronic circuits, including diodes, rectifiers, Zener regulators, BJTs, and operational amplifiers.
5. To introduce the fundamentals of digital electronics and electricity billing, and electrical safety measures including fuse, MCB, and electric shock protection.

Course Outcomes: *After successful completion of this course, the student will be able to*

CO1	Apply Ohm's law, Kirchhoff's laws, and network theorems to analyse and simplify DC electrical circuits.	K3
CO2	Analyze single- phase AC circuits using phasor concepts, impedance, and power calculations, and the basic concepts of three-phase systems.	K4
CO3	Understand the construction, operating principles, basic equations, speed-control methods, and applications of DC and AC machines.	K2
CO4	Apply the operating principles of semiconductor devices, rectifiers, Zener regulators, BJTs, and operational amplifiers in basic electronic circuits.	K3
CO5	Analyze basic digital logic circuits, electricity billing, and electrical safety measures including fuse, MCB, and electric shock protection.	K4

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

1 - Low, 2 - Moderate, 3 – High

UNIT-I

DC Circuits and Network Theorems: Electrical circuit elements and terminology; Ohm's law; Kirchhoff's Current Law (KCL) and Voltage Law (KVL); series-parallel DC circuits; mesh and nodal analysis Thevenin's theorem, Norton's theorem, Superposition theorem(treatment of concepts with independent sources only).

UNIT-II

AC Circuits: Generation of alternating EMF; peak, average, RMS values, form factor and peak factor; Voltage and current relationship with phasor diagrams in R, L, and C series circuits only, concept of reactance

and impedance, concept of power factor, active power, reactive power and apparent power; introduction to three-phase systems; star and delta connections (line and phase relations only).

UNIT-III

Electrical Machines: DC machines: Principle of operation of DC Generator; Principle of operation of DC Motor, Torque Equation, types of DC motors and applications, speed control using flux control & armature voltage control methods; Transformers: working principle, EMF equation, losses, and efficiency; three-phase induction motor: principle of operation and applications; principle of operation of Stepper Motor and DC Servo motor.

UNIT-IV

Semiconductor Devices and Electronic Circuits: Semiconductor basics: intrinsic and extrinsic semiconductors; PN junction diode and its V-I characteristics; Operation of half-wave and full-wave bridge rectifiers without filters; Zener diode and voltage regulation; operation of PNP and NPN junction transistors, CE Configuration - input and output characteristics; Operational amplifiers: inverting and non-inverting amplifiers

UNIT-V

Digital Electronics, Electricity Billing & Safety : Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates: NOT,OR,AND,NOR,NAND,XOR and XNOR; Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Types of Tariff, calculation of electricity bill for domestic consumers; Equipment safety measures**:** working principle of fuse and Miniature Circuit Breaker (MCB), Electric Shock, Safety Precautions to avoid shock.

Learning Resources:

Textbooks

1. EdHughes. (2016). Electrical & Electronic Technology (12th edition). Pearson Education.
2. Vincent Del Toro. (2015). Electrical Engineering Fundamentals (2nd edition).Pearson Education.

Reference Books

1. Mehta, V.K., & Mehta,R. (2008). Principles of electrical engineering and electronics. S.Chand Publishing.
2. Charles K.Alexanderand Mathew N.O.Sadiku. (2017). Fundamentals of Electrical Circuits(6th edition). Mc Graw-Hill Education, India.
3. V.K.Mehta,Rohit Mehta,(2022).Principles of Power Systems.S.Chand Publishing.

Web Resources

1. https://nptel.ac.in/courses/108105112
2. https://nptel.ac.in/courses/108101091
3. https/nptel.ac.in/courses/108105113

CATEGORY ESC	COMPUTATIONAL THINKING AND PROBLEM SOLVING USING PYTHON	L	T	P	C
COURSE CODE: A2610018		3	0	0	3

Pre-requisites: NIL

Course Objectives:

1. Establish computational thinking, decomposition, pattern recognition, abstraction, and algorithmic reasoning as the foundation for problem-solving, with strong grounding in algorithm design and flow chart construction.
2. Develop proficiency in Python control structures while explicitly linking conditionals to abstraction and loops to pattern recognition.
3. Build competence in selecting Python data structures (strings, lists, tuples, dictionaries) as an exercise in abstraction and pattern-based organization of information.
4. Train students to decompose problems into functions and recursive sub-problems, reason informally about algorithmic efficiency, and use AI coding assistants responsibly.
5. Equip students with file handling, exception handling, and basic data analysis / visualization skills framed as decomposing a larger data workflow into manageable, robust steps and to integrate these skills in a Cap stone mini-project.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Explain the principles of computational thinking and interpret algorithms and flowcharts that Represent problem-solving logic.	K2
CO2	Apply pattern recognition and abstraction, via Python control structures, to implement step-by- step algorithmic solutions	K3
CO3	Analyze problems to select and manipulate appropriate data structures (strings, lists, tuples, dictionaries) as an abstraction and organization exercise	K4
CO4	Evaluate the correctness and efficiency of decomposed, modular algorithms and Python programs through tracing, testing, debugging, and exception handling.	K5
CO5	Create modular, well-structured Python programs by decomposing problems into functions, recursion, file handling, and data analysis, culminating in an integrative capstone project.	K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	-	1	-	2	2	2	1	1
CO2	3	3	2	2	3	-	-	1	1	-	2	3	3	2	2
CO3	3	3	2	2	3	-	-	1	1	-	2	3	3	2	2
CO4	3	3	2	3	3	-	1	1	2	-	3	3	3	2	3
CO5	3	3	3	3	3	1	1	2	3	1	2	3	3	3	3
1 - Low, 2 - Moderate, 3 - High															

UNIT–1: **Computational Thinking, Algorithm Design & Flow charting**

Computational thinking pillars - decomposition, pattern recognition, abstraction, algorithmic thinking, and the problem-solving process. Algorithm design - characteristics of a good algorithm, stepwise refinement, pseudocode.

Flowcharts - standard symbols, construction rules, and manual tracing for verification. Translating algorithms and flowcharts into Python code - variables, data types, operators, and input/output. Introduction to good coding practice- doc strings, inline comments, and print-based debugging, threaded through every unit from here on.

UNIT–2: **Control Structures**

Conditional statements – as abstraction over multiple cases. Loops (for, while)-as pattern recognition of repetition. Nested loops and loop control (break, continue, pass)-as decomposition of complex repetitive logic.

UNIT–3: **Data Structures**

Data Structures—Strings, Lists, Tuples & Dictionaries Strings - pattern matching and abstraction of text as a sequence. Lists- abstraction of ordered, mutable collections. Tuples and dictionaries – abstraction of fixed and key-based data

UNIT – 4: **Functions & Modular Programming**

Functions – decomposition of a program into independent, reusable sub-problems.
Recursion - algorithmic thinking applied to self-similar sub-problems.
Basic algorithmic efficiency - informal comparison of iterative vs. recursive approaches and their time trade-offs.
Modules and built-in libraries, including responsible AI-assisted coding practices.

UNIT – 5: **File Handling, Exception Handling**

File Handling, Exception Handling, Data Analysis & Capstone Project File handling - decomposition of a data workflow into read/process/write stages. Exception handling-abstraction of error cases into predictable, manageable patterns.
Introduction to data analysis and visualization (Num Py / Panda s/ Mat plot lib basics) – pattern recognition in real data sets. Capstone integration - combining all prior units into one end-to-end project.

Learning Resources:

Text Books:

1. Downey, A.B.(2015).Think Python: How to think like a computer scientist(2nded.).O'Reilly Media.
2. Guttag,J. V.(2021).Introduction to computation and programming using Python: With application to computational modeling and understanding data (3rd ed.). MIT Press.

Reference Books:

1. Sweigart,A.(2025).Automate the boring stuff with Python: Practical programming for total beginners (3rd ed.). No Starch Press.
2. McKinney,W.(2022).Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter (3rd ed.). O'Reilly Media.
3. Wing, J.M.(2006).ComputationalthinkingCommunicationsoftheACM,49(3),33–35. https://doi.org/10.1145/1118178.1118215

Web References:

1. Python Software Foundation.(n.d.).ThePythontutorial.https://docs.python.org/3/tutorial/
2. W3Schools.(n.d.).Pythontutorial.https://www.w3schools.com/python/
3. NPTEL.(n.d.).Programming,datastructuresandalgorithmsusingPython.https://nptel.ac.in

CATEGORY ESC	COMPUTATIONAL THINKING AND PROBLEM SOLVING USING PYTHON LAB	L	T	P	C
COURSE CODE: A2610019		0	0	3	1.5

Pre-requisites: NIL

Course Objectives:

1. Establish computational thinking, decomposition, pattern recognition, abstraction, and algorithmic reasoning as the foundation for problem-solving, with strong grounding in algorithm design and Flowchart construction.
2. Develop proficiency in Python control structures while explicitly linking conditionals to abstraction and loops to pattern recognition.
3. Build competence in selecting Python data structures (strings, lists, tuples, dictionaries) as an Exercise in abstraction and pattern-based organization of information.
4. Train students to decompose problems into functions and recursive sub-problems, reason informally About algorithmic efficiency, and use AI coding assistants responsibly.
5. Equip students with file handling, exception handling, and basic data analysis/visualization skills framed as decomposing a larger data workflow into manageable, robust steps and to integrate these skills in a Capstone mini-project.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Explain the principles of computational thinking and interpret algorithms and flowcharts that represent problem-solving logic.	K2
CO2	Apply pattern recognition and abstraction, via Python control structures, to implement step-by-step algorithmic solutions.	K3
CO3	Analyze problems to select and manipulate appropriate data structures (strings, lists, tuples, dictionaries) as an abstraction and organization exercise.	K4
CO4	Evaluate the correctness and efficiency of decomposed, modular algorithms and Python programs through tracing, testing, debugging, and exception handling.	K5
CO5	Create modular, well-structured Python programs by decomposing problems into functions, recursion, file handling, and data analysis, culminating in an integrative capstone project.	K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	-	1	-	2				
CO2	3	3	2	2	3	-	-	1	1	-	2				
CO3	3	3	2	2	3	-	-	1	1	-	2				
CO4	3	3	2	3	3	-	1	1	2	-	3				
CO5	3	3	3	3	3	1	1	2	3	L	2				
1 - Low, 2 - Moderate, 3 - High															

Week 1 (Unit 1):

(1) Find the largest of three numbers.

(2) Check whether a given year is a leap year.

Week 2 (Unit 1):

(1) Computes imply interest given principal, rate, and time.
(2) Compute the area and perimeter of a rectangle from user input.
(3) Swap two numbers without using a third variable.

Week 3 (Unit 2):

(1) Determine whether a number is positive, negative, or zero.
(2) Check if a given number is prime.
(3) Convert temperature between Celsius and Fahrenheit based on user choice.
(4) Determine BMI category (underweight / normal / overweight / obese) using elif.
(5) Classify a triangle as equilateral, isosceles, or scalene.

Week 4 (Unit 2):

(1) Print all Armstrong numbers between 1and 1000.
(2) Generate the Fibonacci series upto n terms using a loop.
(3) Find the GCD and LCM of two numbers using a while loop.
(4) Simulate a simple ATM PIN – entry system allowing a maximum of 3 attempts.
(5) Find the first n prime numbers using nested loops with break.

Week 5 (Unit 3):

(1) Encrypt a message using a Caesar cipher.
(2) Check if two given strings are anagrams of each other.
(3) Check whether a given string is a palindrome using slicing and string methods.
(4) Count vowels, consonants, digits, and spaces in a given string.

Week 6 (Unit 3):

(1) Find the second – largest element in a list of exam scores.
(2) Merge two sorted lists of student roll numbers into a single sorted list.
(3) Generate squares of all even numbers from 1 to 50 using list comprehension.
(4) Store and retrieve student records using a dictionary (roll number as key, tuple of name / marks as value)

Week 7 (Unit 3):

(1) Store coordinates (x, y) as tuples in a list and compute the distance between consecutive points.
(2) Count the frequency of each word in a paragraph using a dictionary.
(3) Maintain an inventory system (item name as key, tuple of price and quantity as value) that updates stock after each transaction.

Week 8 (Unit 4):

(1) Using a function, check if a number is "perfect, "and list all perfect numbers upto 10,000.
(2) Using *args, compute the total resistance of resistors in series or parallel.
(3) Define a function with default/keyword arguments to compute the area of different shapes based on shape type and use it.
(4) Write a function that returns the mean, median, and mode of a list of numbers.

Week 9(Unit 4):

(1) Compute the GCD of two numbers recursively using the Euclidean algorithm.
(2) Compute factorial using recursion.

(3) Solve the Tower of Hanoi problem for n disks recursively and count the number of moves.
(4) Compute the range and maximum height of a projectile given initial velocity and angle, using the math module.

Week 10 (Unit 5):

(1) Count the words, lines, and characters in a given text file.
(2) Read a log file of sensor readings and appendane w set of readings with a time stamp.
(3) Read a text file of daily temperature readings and write the maximum, minimum, and average to an output file

Week 11 (Unit 5):

(1) Build a simple calculator that gracefully handles Zero Division Error, Value Error, and invalid operators.
(2) Safely compute the roots of a quadratic equation using try-except-finally, abstracting invalid input and division-by-zero into predictable, handled error patterns.
(3) Read a CSV of student marks and write the names of students scoring above 75% to a new file.
(4) Validate user input for a unit – conversion tool and raise a custom exception for out – of – range values.
(5) Using Pandas, read a CSV of daily electricity consumption and plot a line graph over a month, recognizing weekday / weekend consumption patterns.

Week 12 (Unit 5):

(1) Capstone Mini-Project: "Dataset Health-Check & Insights Tool" — decompose the workflow into read → validate → clean → analyze → visualize → report stages, using exception handling and NumPy /Pandas / Mat plot lib, submitted with a one-page reflection.

Learning Resources:

Text Books:

1. Downey,A.B.(2015).Think Python: How to think like a computer scientist (2nded.).O'Reilly Media.
2. Guttag,J.V.(2021).Introduction to computation and programming using Python: With application to computational modeling and understanding data (3rd ed.). MIT Press.

Reference Books:

1. Sweigart, A. (2025). Automate the boring stuff with Python: Practical programming for total beginners (3rd ed.). No Starch Press.
2. McKinney,W.(2022). Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter (3rd ed.). O'Reilly Media.
3. Wing,J.M. (2006). Computational thinking. Communications of the ACM, 49(3),33–35. https://doi.org/10.1145/1118178.1118215

Web References:

1. Python Software Foundation. (n.d.). The Python tutorial .https://docs.python.org/3/tutorial/
2. W3 Schools.(n.d.).Python tutorial. https://www.w3schools.com/python/
3. NPTEL.(n.d.). Programming, data structures and algorithms using Python. https://nptel.ac.in

CATEGORY ESC	AI TOOLS AND APPLICATIONS	L	T	P	C
COURSE CODE: A2610022		0	1	3	2.5

Pre-requisites: NIL

Course Objectives: To familiarize students with the landscape of AI tools and their underlying working principles.

1. To develop competence in prompt engineering for effective interaction with generative AI systems.
2. To enable students to apply AI tools for data analysis, visualization, and interpretation.
3. To train students in using AI-assisted tools for coding, writing, and productivity tasks.
4. To instill awareness of ethical, legal, and societal considerations in AI tool usage.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Recall the categories, capabilities, and limitations of major AI tools (text, image, code, data)	K1
CO2	Explain the principles of prompt engineering and how generative AI models process instructions.	K2
CO3	Apply AI tools to solve first – year engineering problems in analysis, writing, and coding tasks.	K3
CO4	Analyze AI – generated outputs for accuracy, bias, and reliability before use.	K4
CO5	Evaluate the ethical, academic integrity, and societal implications of AI tool use, justifying appropriate usage choices.	K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	–	–	–	3	1	1	–	–	–	1				
CO2	2	2	–	–	3	1	–	1	–	2	1				
CO3	3	3	2	2	3	1	1	–	1	2	2				
CO4	2	3	2	3	3	2	2	3	1	2	2				
CO5	1	2	2	2	2	3	3	3	2	3	2				
1 - Low, 2 - Moderate, 3 - High															

Unit 1: Introduction to AI and the AI Tools Landscape

What is AI, Machine Learning, and Generative AI — basic definitions and how they relate to one another. Core categories of AI tools: conversational / text, code assistants, data – analysis tools, image – generation tools, and writing / productivity tools. How large language models process and generate responses (conceptual, non-mathematical overview). Criteria for selecting the right AI tool for a given task — accuracy needs, cost, data sensitivity, and output format. Setting up accounts and workspaces; understanding free-tier versus paid-tier capabilities and limitations.

Widely Used AI Tools by Application (for classroom coverage):

Category	Example Tools	Typical Application

Conversational / General - Purpose AI	Chat GPT, Claude, Gemini, Perplexity	Writing, research, coding help, file / data analysis, cited web search
AI Coding Assistants	GitHub Copilot, Cursor, Claude Code	In-IDE code completion, AI-Native editing, multi – file a gentic coding
Data Analysis Tools	ChatGPT (Advanced Data Analysis), Microsoft Copilot in Excel, Julius AI	Upload a dataset, generate Statistics / charts, spreadsheet formulas via natural language
Image Generation	Mid journey, DALL· E3, Stable Diffusion / Flux	Illustrations, concept art, design mockups
Writing & Productivity	Grammarly, Gamma, Fathom, Notion AI	Grammar / style checking, slide generation, meeting summaries, task automation
Audio, Video & Presentation (optional)	Eleven Labs, Runway / Sora, Synthesia	Text-to-speech, AI video Generation, script-to-video presentations

Teacher Practical Examples (for classroom demonstration):

1. Live comparison of the same general engineering query (e.g., "explain the engineering design process") answered by two different AI Chabot's, highlighting differences in response style and accuracy.
2. Walk through of an AI tool's interface — settings, conversation history, file upload, and model selection — using a common platform.

Student Exercise Problems (for practice):

1. Create accounts on two AI platforms and compare their responses to a simple engineering question (e.g., "explain the difference between analysis and design").
2. Prepare a one – page comparison chart of five AI tools by category and primary use case.
3. Write a short reflection identifying one task in your daily academic life where an AI tool could help.

Unit 2: Prompt Engineering and Generative AI Tools

Anatomy of a good prompt — context, clear instruction, desired format, and constraints. Zero-shot, few-shot, and chain-of-thought prompting techniques and when to use each.
Role-based and context – setting prompts (e.g., asking the AI to respond as are viewer, tutor, or domain expert).
Iterative prompt refinement — diagnosing a poor AI response and rewriting the prompt to fix it.
Using generative AI for brainstorming, summarizing, and drafting technical content.

Teacher Practical Examples (for classroom demonstration):

1. Refine a vague prompt (e.g., "explain project scheduling") into a precise one step-by-step, showing output improvement at each stage.
2. Demonstrate few-shot prompting by providing examples to guide the AI toward a specific output format (e.g., a formatted comparison table).

Student Exercise Problems (for practice):

1. Write three versions of a prompt (basic, detailed, role-based) for the same task and compare outputs.
2. Use an AI tool to summarize a one – page technical article and verify the summary against the original.
3. Draft a chain-of-thought prompt to solve a multi – step numerical / logical problem (e.g. a unit-conversion or estimation problem) and check the reasoning.

Unit 3: AI Tools for Data Analysis and Visualization

AI-assisted spreadsheet and dataset analysis using natural-language commands. Natural-language querying of data sets to extract summary statistics and insights. AI tools for generating charts, graphs, and visual summaries from tabular data.

Interpreting AI-generated statistical summaries correctly and recognizing their limitations. Identifying and correcting errors or misinterpretations in AI-generated data analysis.

Teacher Practical Examples (for classroom demonstration):

1. Upload a small data set (e.g., class attendance or survey data) to an AI tool and generate a summary-statistics report and chart using natural-language commands. Demonstrate how to verify and correct it.

Student Exercise Problems (for practice):

1. Use an AI tool to clean and summarize a small sample data set (e.g., class attendance or marks data).
2. Generate three different chart types from the same data set using AI prompts and justify which is most appropriate.
3. Cross-check one AI-generated statistical claim manually and report any discrepancy found.

Unit 4: AI Tools for Coding, Writing, and Productivity

AI coding assistants—code generation, explanation, and debugging support for simple programs. AI writing assistants for reports, emails, and technical documentation. AI tools for scheduling, note-taking, and meeting / lecture summarization. AI-assisted presentation and slide – outline generation from a topic prompt.

Integrating AI tools into an efficient day-to-day academic and engineering work flow.

Teacher Practical Examples (for classroom demonstration):

1. Use an AI coding assistant to generate a simple program (e.g., a temperature converter), then intentionally introduce a bug and have the AI debug it.
2. Generate a presentation outline and speaker notes from a topic prompt using an AI writing / productivity tool.

Student Exercise Problems (for practice):

1. Use an AI coding tool to write and debug a simple program for a given problem statement.
2. Draft a formal email or short report using an AI writing assistant, then manually edit it for accuracy and tone.
3. Generate a slide outline for a 5-minute seminar topic using an AI tool and refine it.

Unit 5: Ethics, Reliability, and Emerging Trends

Bias and hallucination in AI outputs, and techniques for detecting and fact-checking them. Academic integrity and appropriate citation of AI assistance in course work and submissions. Data privacy and security considerations, including obligations under India's Digital Personal Data Protection Act, 2023 (DPDP Act), when uploading personal or institutional data. Copy right and intellectual property considerations in AI-generated text and image content. Emerging trends—multi modal AI and AI agents—and their implications for future engineering practice.

Teacher Practical Examples (for classroom demonstration):

1. Show a documented case of AI hallucination (a fabricated factor citation) and demonstrate how to fact - check it.
2. Walk through an example of properly citing AI assistance in an academic submission per institutional guidelines.
3. Walk through a worked example of checking whether AI-generated text or image output raises a copyright / IP concern (e.g., close paraphrasing of a source).

Student Exercise Problems (for practice):

1. Identify and document a hallucination or bias instance produced by an AI tool on a factual query.
2. Draft an "AI usage declaration" for a hypothetical assignment, citing tools and extent of use appropriately.
3. Review the data – handling / privacy policy of one AI tool used in this course and identify one DPDP Act, 2023 compliance consideration relevant to student data.

Learning Resources:

Text Books

1. Marr,B.(2024). Generative AI in practice: 100+ amazing ways generative artificial intelligence is changing business and society. Wiley.
2. Mollick,E.(2024). Co-intelligence: Living and working with AI .Portfolio / Penguin.

Reference Books

1. Selwyn,N. (2022). Education and technology: Key issues and debates (3rded.).Blooms bury.
2. Susskind,R., & Susskind, D. (2022). The future of the professions: How technology will transform the work of human experts (Updated ed.). Oxford University Press.
3. Russell,S.,& Norvig,P. (2021). Artificial intelligence: A modern approach (4thed.).Pearson.

Web Resources

1. Google.(n.d.).Google AI essentials. Grow with Google. https://grow.google/ai-essentials/
2. Open AI. (n.d.). Open AI documentation and guides. https://platform.openai.com/docs
3. Anthropic. (n.d.). Prompt engineering overview. Claude Docs. https://docs.claude.com/en/docs/build-with-claude/prompt-engineering/overview
4. UNESCO.(2023).Guidance for generative AI in education and research. https://unesdoc.unesco.org/
5. AICTE. (2025). AICTE inputs on Artificial Intelligence — Year of AI initiative. https://www.aicte.gov.in/downloads/initiatives/AICTE%20inputs%20on%20Artificial%20Intelligence%20-compre hensive.pdf
6. Ministry of Electronics and Information Technology, Government of India. (2023). Digital Personal Data Protection Act, 2023. https://www.meity.gov.in/content/digital-personal-data-protection-act-2023

CATEGORY ESC	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C
Course Code: A2610204		0	0	3	1.5

Pre-requisites: Nil

Course Objectives:

1. To develop practical skills in measuring voltage, current, power, and power factor in DC and AC electrical circuits and in experimentally verifying basic circuit laws and analysis methods.
2. To develop practical understanding of the operation, speed-control methods of DC shunt motors, and domestic energy consumption.
3. To familiarise students with the characteristics and applications of semiconductor devices, rectifier and transistor circuits, and basic digital logic gates.

Course Outcomes: *After successful completion of this course, the student will be able to*

CO	Course Outcome Statement	K Level
CO1	**Apply** electrical measuring instruments and circuit analysis methods to measure electrical quantities and verify circuit laws, theorems, mesh, and nodal analysis.	K3
CO2	Analyse the speed-control methods of DC shunt motor and analyse the characteristics of PN junction, Zener diodes and determine domestic electrical energy consumption.	K4
CO3	**Analyze** the operation of rectifier and transistor circuits, and basic & universal digital logic gates.	K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	2	3	-	-	1	-	-	-	2	3
CO2	3	3	-	2	2	-	-	1	-	-	-	2	3
CO3	3	3	-	2	3	-	-	1	-	-	-	3	3
1 - Low, 2 - Moderate, 3 – High													

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Verification of Kirchhoff's Laws in a DC circuit.
2. Measurement of voltage, current, and power in a DC circuit.
3. Measurement of voltage, current, power, and power factor in an AC circuit.
4. Verification of the superposition theorem for a linear DC network containing multiple independent sources.
5. Measurement of voltages and currents using mesh and nodal analysis in a circuit.
6. Verification of Thevenin's theorem and determine its equivalent parameters.
7. Verification of Norton's theorem and determine its equivalent parameters.
8. Speed control of DC shunt motor using armature voltage method.
9. Speed control of DC shunt motor using field control method.
10. Determination of electrical energy consumption in domestic premises.
11. Investigate the characteristics of a Zener diode as a voltage regulator.
12. Plot the V-I characteristics of a PN junction diode.

13. Analyse the input and output waveforms of a half-wave rectifier.
14. Analyse the input and output waveforms of a full-wave rectifier.
15. Analyse the input and output characteristics of a BJT in CE configuration.
16. Investigate logic behaviour of AND,OR, NAND,NOR, XOR, and universal NAND gates.

Learning Resources:

Text books

1. EdHughes. (2016). Electrical & Electronic Technology(12th edition).Pearson Education.
2. Vincent DelToro.(2015).Electrical Engineering Fundamentals(2nd edition).Pearson Education.

Reference Books

1. Mehta,V.K.,& Mehta,R.(2008).Principles of electrical engineering and electronics.S.Chand Publishing.
2. Charles K.Alexander and Mathew N.O.Sadiku.(2017).Fundamentals of Electrical Circuits (6th edition). McGraw-Hill Education, India.
3. V.K.Mehta,Rohit Mehta,(2022).Principles of Power Systems.S.Chand Publishing.

Web Resources

1. https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html
   https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html

CATEGORY ESC	ENGINEERING GRAPHICS LAB	L	T	P	C
COURSE CODE: A2610300		0	1	3	2.5

Pre-requisites: Nil

Course Objectives: ***The course aims to***

1. **Develop spatial visualization and graphical communication skills** for representing engineering objects, components, structures and systems.
2. **Introduce the principles, conventions and standards of engineering graphics**, including geometrical constructions, scales, dimensioning, projections and sectional representation.
3. **Develop the ability to visualize and represent three-dimensional engineering entities** through orthographic, isometric, sectional and surface-development techniques.
4. **Develop proficiency in computer-aided engineering graphics**, including 2D drafting, 3D modelling, visualization and generation of engineering drawings.
5. **Enable students to communicate engineering design information effectively** through freehand sketches, conventional drawings and digital CAD models across different engineering disciplines.

Course Outcomes: *At the end of the course, the student will be able to:*

COs	Course Outcome Statement	K level
CO1	Apply standard engineering graphics principles and conventions to prepare accurate sketches and engineering drawings.	K 1
CO2	Visualize and represent three-dimensional objects and systems using appropriate projection, orthographic, isometric, sectional, and surface-development techniques.	K 3
CO3	Interpret and transform engineering representations by converting between 2D drawings, 3D views, and physical objects.	K 3
CO4	Use CAD tools to create, modify, and communicate 2D drawings and 3D models with appropriate dimensions, annotations, symbols, and features.	K 3
CO5	Communicate engineering design information effectively through graphical representations, CAD models, and engineering drawings for multidisciplinary engineering applications.	K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	–	2	1	–	2	2	3	–		
CO2	3	3	3	2	2	1	–	2	2	2	–		
CO3	3	3	3	2	3	2	–	2	2	2	–		
CO4	3	3	3	2	3	1	–	2	2	3	2		
CO5	3	3	3	2	3	2	2	3	3	3	2		
1 - Low, 2 - Moderate, 3 - High													

SECTION A – Manual Engineering Drawing.

Exp.	Practical Exercise
1	**Fundamentals of Engineering Drawing:** Lines, lettering, dimensioning, geometrical constructions, symbols and standard drawing conventions
2	**Engineering Curves:** Construction and applications of ellipse, parabola, hyperbola, cycloid, involute and other commonly used engineering curves
3	**Projection of Points and Straight Lines:** Projection of points in different quadrants and straight lines in different orientations
4	**Projection of Planes:** Projection of simple planes parallel, perpendicular and inclined to reference planes
5	**Projection of Solids and Engineering Objects:** Projection of basic solids and simple engineering objects in different orientations
6	**Orthographic and Isometric Views:** Conversion between orthographic and isometric representations of simple engineering objects and system**s**
7	**Sections of Solids and Engineering Objects:** Sectional views and true shapes of simple solids and objects
8	**Development of Surfaces:** Development of surfaces of prismatic, cylindrical, pyramidal, conical and other developable forms

SECTION B – Computer-Aided Engineering Graphics (CAD)

Exp.	Practical Exercise
9	**Introduction to 2D CAD:** Drawing setup, basic drawing and editing commands, layers, dimensions, text, symbols and hatching, Construction of polygons, circles, arcs, ellipse and other engineering curves using CAD.
10	**2D CAD – Orthographic Views:** Preparation of front, top, side and other appropriate views of simple engineering objects

Learning Resources:

Textbook:

1. Bhatt, N. D., & Panchal, V. M. (2023). Elementary engineering drawing (53rd ed.). Charotar Publishing House.
2. Narayana, K. L., Kannaiah, P., & Reddy, K. V. (2020). Engineering graphics (2nd ed.). Scitech Publications.

Reference Books:

1. Venugopal, K., & Prabhu Raja, V. (2019). Engineering drawing and graphics (5th ed.). New Age International.
2. Gopalakrishna, K. R. (2018). Engineering drawing (Vols. 1–2). Subhas Stores.

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CATEGORY **HSM**	**ENGLISH FOR TECHNICAL COMMUNICATIONS** (Common to all Branches)	**L**	**T**	**P**	**C**
COURSE CODE **A2610000**		**3**	**0**	**0**	**3**

Pre-requisites: Nil

COURSE OBJECTIVES:

1. Listen the authentic texts to comprehend and respond appropriately as both audience and conversant;
2. Communicate in academic and social (formal) contexts with reasonable fluency and accuracy (neutral accent, social and grammatical appropriateness);
3. Comprehend the texts of various types for academic, technical and career purposes;
4. Write for academic and professional purposes;
5. Communicate across cultures that requires a blend of cognitive, interpersonal, and linguistic skills

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Comprehend specific information, context, and central ideas from social, academic, or workplace conversations and audio-visual material.	**K2**
CO2	Apply appropriate social norms to bridge the gaps and collaborate effectively across diverse cultural backgrounds	**K3**
CO3	Examine discourse features and speech strategies to participate effectively in group discussions, informal exchanges, and short presentations on technical and general topics.	**K4**
CO4	Evaluate the content, limitations and ethical aspects of AI tools in communication and language learning, and apply them to create concise, accurate essays/summaries.	**K5**
CO5	Construct well-organized paragraphs, essays, critical reviews, and other professional documents suited to academic and workplace contexts.	**K6**

[#] Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	-	-	-	-	-	-	-	2	3	-	-	-	-
CO3	-	-	-	-	-	-	2	2	3	-	-	-	-
CO4	-	-	-	-	2	-	-	2	3	-	2	-	-
CO5	-	-	-	-	-	-	2	2	3	-	1	-	-

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT 1

Effective Communication: Exploring Channels and Methods Vocabulary: Roots, Prefixes, and Suffixes Homonyms

Grammar: Articles, Prepositions, Tenses.

Reading: Definition and Importance, Skills and Sub-Skills of Reading

Writing: Cohesion and Coherence, Paragraph Writing.

Listening: Listening for main ideas and supporting details, Note-taking

Speaking: Introducing self and others, describing people and objects, JAM

UNIT 2

Eco-Consciousness: Negotiating for a Sustainable Future Vocabulary: Contractions, Phrasal Verbs, Idioms & Phrases

Grammar: Subject-Verb Agreement, Conditional Sentences

Reading: Reading for Inference, Point of View, Tone and Perspective.

Writing: Note making, Summarizing, Paraphrasing.

Listening: Listening to various texts and comprehension

Speaking: Role-plays, Extempore.

UNIT 3

Disruptive Technologies: Ethical Implications and Future Prospects Vocabulary: One-Word Substitutes, Commonly Confused Words

Grammar: Degrees of Comparison, Active and Passive Voice, Question Tags.

Reading: Reading the extracts/articles/ essays of the News Papers, Journals and literary texts.

Writing: Paraphrasing, Letter Writing

Listening: Listening to stories, news, documentaries and discussions.

Speaking: Debate, Group Discussions

UNIT 4

Entrepreneurship and Start-Up Culture: Emerging Trends Vocabulary: Business/ Profession/ Career/ Job-related Vocabulary.

Grammar: Sentence Synthesis, Simple, Compound and Complex Sentences.

Reading: Reading various texts for global understanding

Writing: Email Writing, Data Interpretation, Report Writing.

Listening: Listening to debates and discussions.

Speaking: Power Point Presentations by Individuals and Teams.

UNIT 5

Ethical Leadership: Integrating Social Responsibility and Core Values Vocabulary: Advanced Vocabulary for GRE/TOEFL/ IELTS/CAT etc.

Grammar: Sentence Synthesis, Para Jumbles.

Reading: Reading texts for global comprehension.

Writing: Book/Film Reviews, Social Media Etiquette

Listening: Listening to the talks/speeches by the eminent personalities

Speaking: Team Discussions and Presentations

LEARNING RESOURCES:

Textbook:

- Chekuri, T., &Perumalla, R. K. (2026). NextGen English for engineers: A course book for technical English communication. Cengage.
- Coelho, P. (2020). The alchemist. Harper Collins. (Non-Detailed Text)

Reference Books:

- Technical Communication (2nd Ed.) by M. Raman & S. Sharma. Oxford University Press, 2012.
- Effective Technical Communication by M.A. Rizvi, Tata McGraw-Hill, 2005.
- English for Engineers and Technologists, Orient Blackswan 2010 (Combined edition, Vol.1 &2).
- The Oxford Guide to Writing and Speaking by John Seely, Oxford University Press, 2004.

Web Resources:

- eGyanKosh. (n.d.). National digital repository. **https://egyankosh.ac.in/**
- Read Theory. (n.d). Adaptive reading comprehension practice. **https://readtheory.org/**

CATEGORY **BSC**	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS** (Common to all Branches)	**L**	**T**	**P**	**C**
COURSE CODE **A2620001**		**3**	**0**	**0**	**3**

Pre-requisites: Mathematics of 10+2 / Intermediate level (algebra, matrices and basic calculus

Course Objectives:

- To prepare the student to calculate gradient, surface and volume integrals by applying standard theorems.
- This course is aimed to provide the learner with several methods for solving differential equation and partial differential equations.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	Cognitive Level
CO1	Model simple physical problems involving rate as first order differential equations and solve the resulting equation	**K4**
CO2	Apply differential equation techniques to formulate and solve homogeneous and non-homogeneous differential equations, solve simultaneous linear differential equations, and apply these methods to model and analyze L-C-R circuit problems and simple harmonic motion	**K3**
CO3	Solve partial differential equations that model physical processes	**K4**
CO4	Apply the knowledge of gradient, divergence and curl and interpret the physical meaning of different operators	**K3**
CO5	Compute the work done against a field, circulation and flux using vector calculus methods	**K4**

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

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

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT-I: DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE

Exact equations and equations reducible to exact form (integrating factor), linear differential equations – Bernoulli's equations. Orthogonal Trajectories, Applications: Newton's Law of cooling –Law of natural growth and decay-Electrical circuits.

UNIT-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS)

Definitions, Homogeneous and non-homogeneous, Complementary function, Particular integral, General solution, Method of variation of parameters-Wronskian. Simultaneous linear equations, Applications to L-CR Circuit problems and Simple Harmonic motion

UNIT-III: PARTIAL DIFFERENTIAL EQUATIONS

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, Solutions of first order linear equations using Lagrange's method, Non-Z.

UNIT-IV: VECTOR DIFFERENTIATION

Scalar and Vector point functions, Vector operator Del, Gradient and applications, Directional derivative, Divergence-Solenoidal and Curl-Irrotational Field - Scalar Potential, Vector identities**.**

UNIT-V: VECTOR INTEGRATION

Lineintegral–Circulation–Workdonebytheforce,Surfaceintegral-flux,Green's theorem in a plane (without proof), Stoke's theorem (without proof), Volume integral, Divergence theorem (without proof) and their applications.

LEARNING RESOURCES:

Text Books:

1. Grewal,B.S.(2024).HigherEngineeringMathematics,45th Edition.KhannaPublishers.
2. Kreyszig,E.(2025).AdvancedEngineeringMathematics,11th Edition.JohnWiley&Sons.

Reference Books:

1. Ramana,B.V.(2017).HigherEngineeringMathematics.McGrawHillEducation.
2. James,G.(2018).AdvancedModernEngineeringMathematics.5thEditionPearsonpublishers.
3. Dass,H.K.(2022).AdvancedEngineeringMathematics,22nd Edition.S.ChandPublications.

Web Resources:

- https://mathworld.wolfram.com/First-OrderOrdinaryDifferentialEquation.html
- https://en.wikipedia.org/wiki/Differential_equation
- https://en.wikipedia.org/wiki/Partial_differential_equation
- https://en.wikipedia.org/wiki/Vector_calculus
- https://en.wikipedia.org/wiki/Vector_calculus

CATEGORY **MNC**	**NSS / COMMUNITY SERVICE** (Common to CE, EEE, ME, ECE and IT)	**L**	**T**	**P**	**C**
COURSE CODE **A2620003**		**0**	**0**	**2**	**0**

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, team work social consciousness among the students and engaging them in selfless service.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Understand the importance of discipline, character and service motto.	**K2**
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques	**K3**
CO3	Explore human relationships by analyzing social problems.	**K4**
CO4	Determine to extend their help for the fellow beings and down trodden people.	**K5**
CO5	Develop leadership skills and civic responsibilities.	**K6**

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	–	–	–	–	2	2	3	2	1	2	-	-
CO2	2	3	2	3	2	3	3	2	2	2	2	-	-
CO3	1	3	–	2	–	3	3	3	3	2	2	-	-
CO4	–	2	–	2	–	3	3	3	3	2	2	-	-
CO5	1	2	2	2	1	3	3	3	3	3	3	-	-

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT-I ORIENTATION

General Orientation on NSS/NCC/Scouts Guides/Community Service activities, career guidance.

Activities:

Conducting–icebreaking sessions-expectations from the course-knowing personal talents and skills
Conducting orientations programs for the students–future plans-activities-releasing roadmap etc.
Displaying success stories-motivational biopic-award winning movies on societal issues etc.
Conducting talent show in singing patriotic songs-paintings-any other contribution.

UNIT-II NATURE &CARE ACTIVITIES

Best out of waste competition.
Poster and signs making competition to spread environmental awareness.
Recycling and environmental pollution article writing competition.
Organizing Zero-waste day.
Digital Environmental awareness activity via various social media platforms.
Virtual demonstration of different eco-friendly approaches for sustainable living.

Write a summary on any book related to environmental issues.

UNIT-III COMMUNITY SERVICE ACTIVITIES

Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
Conducting consumer Awareness Explaining various legal provisions etc.
Women Empowerment Programmes –Sexual Abuse, Adolescent Health and Population Education.
Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

- NirmalyaKumarSinha&SurajitMajumder,*ATextBookofNationalServiceScheme*Vol;I,VidyaKutir Publication, 2021 (ISBN 978-81-952368-8-6)
- *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
- Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e2008
- Masters G.M.,Joseph K.and Nagendran R."Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
- RamAhuja.*Social Problems in India*, Rawat Publications, NewDelhi.

General Guidelines:

Institutes must assign slots in the Time table for the activities.
Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

Evaluated for a total of 100marks

A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, to tolling to 90 marks.
A student 'shall be evaluated by the concerned teacher for 10marks by conducting viva voce on the subject.

CATEGORY **HSM**	**ENGLISH FOR TECHNICAL COMMUNICATIONS AND MOODLES LABORATORY** (Common to all Branches)	**L**	**T**	**P**	**C**
COURSE CODE **A2620004**		**0**	**0**	**3**	**1.5**

Pre-requisites: Nil

COURSE OBJECTIVES:

1. Develop active listening skills and the traits of an effective listener using lab activities and Ai-based listening tools.
2. Develop speaking and presentation skills through structured practice and AI-speech coaching tools.
3. Apply reading techniques and analyze the texts to strengthen comprehension and employability.
4. Apply writing techniques for technical and professional letters, emails, resumes and report writing to enhance employability.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Apply a variety of strategies to interpret and comprehend spoken texts/discourse using contextual clues.	**K3**
CO2	Apply appropriate reading strategies to interpret content/material related to engineering and technology domain.	**K3**
CO3	Participate in discussions and presentations on general and technical topics.	**K3**
CO4	Possess an ability to write clearly on topics related to technology and workplace communication.	**K3**
CO5	Choose functional language, cohesive devices and skills of organization to express clearly in speaking.	**K3**
CO6	Demonstrate proficiency in using Moodle LMS and digital tools for learning, communication, research, presentations, assignments, quizzes, discussions, and academic activities with integrity, responsible AI use, and professional online behavior.	**K3**

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

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

Correlation levels 1, 2 or 3 as defined below

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

Part– A

List of Experiments for English for Technical Communication Lab

(Choose any 10 experiments from Part A)

1. Phonetics & Accent Neutralization

- **Sound Lab Drills:** Students record minimal pairs (e.g., /p/– /b/, /t/ – /d/) and compare waveforms using free apps like Voice Recorder.
- **Pronunciation Clinics:** Peer-correction circles where each student reads a short passage focusing on stress and intonation.
- **IPA Treasure Hunt:** Students receive IPA transcriptions, identify the underlying words, and practice pronouncing them accurately.
- **Shadowing Practice:** Students mimic short audio/video clips (newsreaders, documentary narrators) to improve rhythm and reduce mother-tongue influence (MTI).

2. Introducing Self and Others

- **Speed Networking:** Students rotate every 2 minutes and introduce themselves concisely to a new partner.
- **Identity Cards:** Each student prepares a "professional identity card" and introduces another student based on the card's details.
- **Role-Based Introductions** — Introduce yourself in various specific roles: as a student, intern, job applicant, club member, etc.

3. Brief Talk in Formal/Informal Contexts, JAM / Extempore

- **JAM Box** — A box filled with random topics; students pick one topic and speak extemporaneously for 60 seconds.
- **Context Switch** — Students speak on the exact same topic twice: once formally (e.g., presenting at a seminar) and once informally (e.g., chatting with friends).
- **Prompt Cards** — Situational prompts such as: *"Convince your friend to join a club"* or *"Address a class meeting."*

4. Listening Comprehension

- **Audio Quizzes** — Play short audio clips (e.g., public announcements, professional interviews) and answer multiple-choice questions (MCQs).
- **Gap-Fill Listening** — Provide partially blank transcripts; students listen to the recording and fill in missing words.
- **Error Spotting** — Students listen to a narration and actively identify factual inconsistencies or logical errors.

5. Audio-Based Note Taking & Narrating Events

- **Event Reconstruction** — Play an audio clip describing an incident; students reconstruct the event in 5–6 concise bullet points.
- **Timeline Creation** — Students listen to a narrative or technical process description and construct a chronological timeline.
- **Peer Narration** — One student listens to an audio track and narrates the content to a partner, who takes detailed notes.

6. Process Description & Paragraph Writing (Technical Lab Context)

- **Lab-to-Paragraph** — Following a lab experiment, students write a structured process description using appropriate sequence markers (e.g., *first, subsequently, finally*).
- **Flowchart-to-Paragraph** — Convert a technical flowchart or process diagram into a coherent, well-structured paragraph.

- **Reverse Engineering** — Provide a completed technical paragraph; students deconstruct it back into sequential step-by-step instructions and verify accuracy.

7. Group Discussions & Deliberations – Coming to Consensus

- **Consensus Challenge** — Groups deliberate and must unanimously agree on a single solution to a given problem (e.g., *"Best way to reduce campus waste"*).
- **Fishbowl GD** — An inner circle carries out the discussion while an outer circle observes, evaluates, and provides feedback.
- **Ranking Task** — Groups rank a list of items (e.g., *"Top key skills for employability"*) and justify their final consensus.

8. Micro Presentations (2–5 Minutes)

- **One-Slide Presentation** — Students design a single visual slide and present on their topic for 3 minutes.
- **Teach a Concept** — Students explain a fundamental technical idea in simple terms (e.g., *"How Wi-Fi works"*).
- **Object Talk** — Students bring a physical object and present its core function, history, or underlying mechanism.

9. Explaining Concepts – Technical Text-Based

- **Concept Simplification** — Students read a complex technical paragraph and rewrite it clearly for a lay audience.
- **Peer Teaching** — Students teach a key concept from their specific engineering discipline to a partner from a different discipline.
- **Diagram Explanation** — Students analyze a technical diagram and explain its components and workflow verbally.

10. Presenting Logical Arguments – Debates

- **Two-Minute Debates** — Fast-paced, structured debates featuring timed opening arguments and rebuttals.
- **Evidence Hunt** — Students gather empirical data, statistics, or real-world examples to substantiate their stance before debating.
- **Role-Based Debates** — Students debate a topic from assigned perspectives (e.g., *environmental advocate, policymaker, tech industry executive*).

11. Talking About Social Issues & Data Interpretation

- **Data Talk** — Provide data charts or graphs (e.g., *literacy rates, carbon emissions*); students analyze the trends and present key insights verbally.
- **Issue Circles** — Small groups deliberate on a pressing social issue and formulate one actionable, practical solution.
- **Poster-to-Speech** — Students convert a dense visual infographic into a concise 2-minute oral presentation.

12. Interviews – Formal & Semi-Formal

- **Mock Interview Panels:** Students face a panel of peers acting as interviewers.
- **Resume-based Q&A:** Students ask each other questions based on their resumes.
- **Situational Interviews:** Semi-formal scenarios (e.g., club membership, internship, volunteer role).

Part B

(Any 4 Experiments in Part B)

Moodle Learning Management System: Digital Learning & Academic Skills

Course Objectives:

- To become familiar with Moodle LMS and online learning.
- To develop basic digital and academic skills needed for engineering students.
- To learn effective online communication and collaboration.
- To develop skills in assignments, quizzes, presentations, and refresher modules.
- To practice academic integrity and the responsible use of digital technology.

Course Description:

Moodle Learning Management System: Digital learning to enhance Academic Skills. Students familiarize themselves with Moodle LMS and online learning, communication, and collaboration. They develop skills in assignments, quizzes, presentations, and online interviews. They exercise academic integrity and the responsible use of digital technology, adopting tools such as Grammarly, ChatGPT, Culture Wizard, Quizlet AI, and Google Speech-to-Text to enhance their respective skills.

List of Experiments

Experiment 1: Introduction to Moodle LMS

- Introduction to Moodle
- Student login and profile management
- Moodle dashboard and course navigation
- Accessing announcements and course materials
- Notifications and calendars

Experiment 2: Learning Through Moodle

- Accessing PDFs, videos, web resources, and lecture materials
- Downloading and organizing study materials
- Moodle lessons and learning activities
- Tracking course completion
- Managing deadlines and study schedules

Experiment 3: Assignments, Quizzes, and Assessments

- Understanding assignment instructions
- Creating and uploading assignments
- File formats and file naming conventions
- Online quizzes and question types
- Viewing marks and teacher feedback
- Resubmission and revision strategies

Experiment 4: Digital Communication and Collaboration

- Moodle forums and discussions
- Academic email etiquette
- Online communication and netiquette
- Group activities and peer learning
- Collaborative learning tools
- Digital presentation skills

Experiment 5: Academic Skills for Engineering Students

- Effective note-taking techniques
- Reading and understanding technical material
- Time management and study planning
- Problem-solving and critical thinking
- Basic research and information-search skills
- Preparing technical reports and presentations
- Introduction to citations and referencing

Experiment 6: Academic Honesty

- Plagiarism and how to avoid it
- Copyright and fair use principles
- Responsible use of AI tools
- Digital privacy and cybersecurity basics
- Evaluating reliable online information
- Professional behavior in online environments
- Practical activities

Experiment 7: Students can complete activities such as:

- Create and update a Moodle profile
- Download course material and organize it into folders
- Submit an assignment through Moodle
- Attempt an online quiz
- Participate in a Moodle discussion forum
- Upload a revised assignment after receiving feedback
- Prepare a short technical presentation

Course Materials & Resources

Lab Manual

- *Propel: A Course Book for Technical English Communication.* Cengage Publishers, 2026.

Reference Books

1. Raman, Meenakshi, and Sangeeta Sharma. *Technical Communication.* Oxford University Press, 2018.
2. Taylor, Grant. *English Conversation Practice.* Tata McGraw-Hill Education India, 2016.
3. Hewings, Martin. *Cambridge Academic English (B2).* Cambridge University Press, 2012.
4. Sethi, J., and P. V. Dhamija. *A Course in Phonetics and Spoken English* (2nd ed.). Kindle, 2013.
5. Richards, Jack C., Jonathan Hull, and Susan Proctor. *Interchange Level 3 Student's Book with Self-study DVD-ROM* (Vol. 3). Cambridge University Press, 2012.

Web Resources

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. British Council Online English
5. Let's Talk Podcast
6. mmmEnglish with Emma (YouTube)
7. Arnel's Everyday English (YouTube)
8. engVid with Adam (YouTube)
9. EnglishClass101 (YouTube)
10. Speak English With Tiffani (YouTube)
11. BBC Learning English (YouTube)
12. Learn English with Let's Talk - Free English Lessons (YouTube)
13. English Language Club (YouTube)
14. TED-Ed (YouTube)
15. Oxford Online English (YouTube)

CATEGORY **BSC**	**CHEMISTRY FOR MECHANICAL ENGINEERS**	L	T	P	**C**
COURSE CODE **A2620010**		3	0	0	**3**

Course Objectives:

1. Understand the fundamentals of quantum chemistry, including wave-particle duality, quantum numbers, and molecular orbital theory relevant to computing materials.
2. Comprehend the chemistry and electronic properties of semiconductor and superconductor materials and the chemical processes involved in semiconductor-device fabrication.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Analyze corrosion mechanisms in mechanical components and recommend appropriate protection and surface-treatment methods.	K4
CO2	Evaluate fuel properties and combustion processes for engines and boilers, and assess alternative fuels for automotive applications.	K3, K4
CO3	Apply lubrication principles to select appropriate lubricants for mechanical systems based on operating conditions.	K3
CO4	Analyze engineering materials and composites, relating their chemical composition and processing to mechanical properties.	K3, K4
CO5	Evaluate advanced materials and nanomaterials relevant to mechanical engineering applications.	K5,K6

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	-	-	-	-	-	-	-	2			
CO2	2	2	2	-	-	-	-	-	-	-	2			
CO3	2	2	2	-	-	-	-	-	-	-	2			
CO4	1	1	1	-	-	-	-	-	-	-	2			
CO5	1	1	1	-	-	-	-	-	-	-	2			

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

UNIT-I: CORROSION CHEMISTRY AND PROTECTIVE METHODS

Chemical and electro chemical theories of corrosion, galvanic series, Types of corrosion (galvanic, pitting, inter granular, stress corrosion), Corrosion prevention: cathodic protection; Anodic protection

Protective coatings: Galvanizing (hot-dip galvanizing, electro-galvanizing, sherardizing).

Electroplating (copper and nickel plating), Anodizing: aluminum anodizing, hard anodizing, coloring; surface hardening: carburizing, nitriding, carbo nitriding, flame hardening; conversion coatings: phosphating and chromating.

UNIT-II: ENERGY CHEMISTRY (FUELSA ND COMBUSTION)

Classification, calorific value, HCV and LCV, Dulong's formula, problems; calorific - value determination using a bomb calorimeter, problems.

Solid fuels (coal): Classification (anthracite, bituminous, lignite, peat), analysis (proximate, ultimate),

Liquid fuels (petroleum oil): Composition, refining processes, fractional distillation, cracking — thermal and catalytic- fixed and fluid bed); synthetic fuels (Fischer-Tropsch synthesis)

Green fuels: Green hydrogen, hythane.

Knocking In petrol engines: Octane number, anti-knock additives (TEL, MTBE, ethanol); knocking in diesel engines: cetane number, ignition quality, anti-knock additives.

Combustion— problems.

Fuel cell: Introduction, types of fuel cells, applications.

UNIT-III: CHEMISTRY OF LUBRICANTS AND REFRACTORIES

Lubricants: Functions of lubricants - mechanism [fluid-film (hydrodynamic) lubrication, boundary-film (thin-film) lubrication, extreme-pressure lubrication], classification (solid, semisolid, liquid), Properties of lubricants —viscosity, viscosity index, flashpoint, fire point, cloud point, pour point, aniline point, saponification.

Refractories: Characteristics, classification, properties (refractoriness, refractories under load, thermal spalling, porosity) - factors affecting the refractory materials -applications

UNIT-IV: ENGINEERING MATERIALS AND COMPOSITES

Ferrous alloys: Composition and applications of carbon steels, alloy steels, stainless steels, cast irons; heat treatment — annealing, normalizing, hardening, tempering, age hardening.

Polymer chemistry: Types of polymerization, mechanical properties of polymers, thermoplastics, thermosets; engineering properties and applications of ABS, Bakelite; polymer processing (injection moulding, extrusion moulding, compression moulding, blown film moulding)

Elastomers: Natural rubber, vulcanization, synthetic rubbers (BUNA-Sand BUNA-N).

Ceramics: Alumina, silicon carbide, silicon nitride, zirconia and applications; Composite materials: Classification and applications. Solid waste management: Classification, treatment, recycling relevant to manufacturing and machine-shop operations.

UNIT-V: ADVANCED MATERIALS & NANOCHEMISTRY

Carbon nanomaterials: Fullerenes, carbon nanotubes (CNTs), graphene; synthesis by chemical vapor deposition (CVD) method, sol-gel process (metal oxides nanoparticles), applications.

Nano materials for Mechanical Engineering: Graphene and Graphene-Based Composites, Nanocomposites for Wear and Friction Reduction.

High-Entropy Alloys (HEAs), Smart Materials and Shape-Memory Alloys (Definition, properties, applications).Self-Healing Materials: Types, working, applications.

LEARNING RESOURCES:

Textbooks

1. Jain, P. C., & Jain, M. (2020). Engineering chemistry (17th ed.). Dhanpat Rai Publishing Company.
2. Agarwal, S. (2026). Engineering chemistry (5th ed.). Cambridge University Press.

Reference Books

1. Davis, M. L. (2020). Water and wastewater engineering: Design principles and practice (2nd ed.). McGraw-Hill Education.
2. Shikha, A., & Sharma, R. K. (2019). Engineering chemistry. Krishna Prakashan Media.
3. Dara, S. S., & Umare, S. S. (2018). Engineering chemistry (15th ed.). S. Chand Publishing.

Web Resources

1. Society of Tribologists and Lubrication Engineers. (n.d.). Tribology and lubrication resources. https://www.stle.org
2. ASM International. (n.d.). Materials information and education. https://www.asminternational.org
3. Society of Automotive Engineers. (n.d.). Automotive engineering standards. https://www.sae.org
4. American Society of Mechanical Engineers. (n.d.). Mechanical engineering resources. https://www.asme.org
5. National Association of Corrosion Engineers. (n.d.). Corrosion prevention and control. https://www.nace.org

CATEGORY BSC	CHEMISTRY FOR MECHANICAL ENGINEERS LAB	L	T	P	C
COURSE CODE **A2620015**		0	0	3	**1.5**

Course Objectives:

- To provide hands-on experience in determining fundamental constants and semiconductor band-gap energy through optical and photoelectric experiments.
- To train students in conductometric, potentiometric and cell-based electrochemical measurement techniques.

Course Outcomes:

At the end of the course, the student will be able to:

CO	Course Outcome Statement	K Level
CO1	Understand the Determination of the calorific value of a solid/liquid fuel using a bomb calorimeter.	K3
CO2	Perform conductometric and potentiometric titrations to determine acid-base and redox characteristics..	K3
CO3	Evaluate electrochemical principles study of galvanic corrosion using a zinc–iron electrochemical couple.	K4
CO4	Determination of the thickness of an electroplated coating (copper / nickel) using Faraday's law.	K3
CO5	Determination of strength of an acid in Pb-Acid battery.	K3

Remember; K1- Understand; K2- Apply; K3- Analyze; K4- Evaluate; K5- Create

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

Correlation levels 1, 2 or 3 as defined below
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correction

LISTOF EXPERIMENTS

(Any **TEN** of the following listed experiments)

(Out of which any **TWO** experiments may be conducted in virtual mode)

1. Determination of total hardness of a water sample by the EDTA titrimetric method.
2. Determination of alkalinity of a water sample by acid titration.
3. Determination of dissolved oxygen (DO) in a water sample by Winkler's method.
4. Determination of conductivity of water and soil samples using conductivity meter.
5. Conductometric titration of a strong acid against a strong base.
6. Determination of the corrosion rate of a mild-steel specimen by the weight-loss method.
7. Study of galvanic corrosion using a zinc–iron electro chemical couple.
8. Determination of percentage of iron in cement sample by colorimeter.

9. Preparation and study of a urea-formaldehyde / phenol-formaldehyderes in sample.
10. Determination of the thickness of an electroplated coating (copper/nickel) using Faraday's law.
11. Determination of the fineness of cement by sieve analysis.
12. Determination of the setting time (initial and final) of cement using a Vi cat apparatus.
13. Potentiometric titration of a strong acid against a strong base.
14. Determination of strength of an acid in Pb-Acid battery.
15. Photo catalytic degradation of dye.
16. Re-dox titration using potentiometer.
17. Determination of Ph of water and soil samples using a pH meter.
18. Determination of the Biochemical Oxygen Demand (BOD) of a waste water sample.

References:

1. Vogel,A.I.(2012).Vogel'stextbookofquantitativechemicalanalysis(6thed.).Pearson Education.
2. Ahluwalia,V.K.,&Dhingra,S.(2017).Comprehensivepracticalorganicchemistry.UniversitiesPress.

Virtual Labs:

- Ministry of Education, Government of India. https:vlab.co.in

CATEGORY ESC	ENGINEERING MECHANICS	L	T	P	C
Course Code: A2620300		3	0	0	3

Pre-requisites: Nil

Course Objectives: ***The course aims to***

1. To understand the fundamentals of force systems and equilibrium.
2. To analyse rigid bodies using equilibrium principles and friction laws.
3. To determine centroids and moments of inertia of composite sections.
4. To understand the kinematics of particles.
5. To apply kinetics principles to engineering problems.

Course Outcomes: *At the end of the course, the student will be able to:*

COs	Course Outcome Statement	K level
CO1	Apply the fundamental principles of engineering mechanics to resolve forces, determine moments, and analyze force systems in equilibrium.	K3
CO2	Analyze the equilibrium of rigid bodies and solve engineering problems involving friction, wedges, ladders, and belt drives.	K3
CO3	Determine the centroids and moments of inertia of simple and composite geometrical sections using standard formulae and theorems.	K3
CO4	Analyze the rectilinear and curvilinear motion of particles using kinematic equations, motion diagrams, and relative motion principles.	K3
CO5	Apply Newton's laws, D'Alembert's principle, work-energy, and impulse-momentum principles to solve particle kinetics and impact problems.	K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	1	--	--	--	1	1	--		
CO2	3	2	3	2	1	--	1	--	1	1	--		
CO3	3	3	2	1	1	--	--	--	1	1	--		
CO4	3	2	3	2	2	--	1	--	1	1	--		
CO5	2	3	3	2	3	--	1	--	1	2	1		
1 - Low, 2 - Moderate, 3 - High													

UNIT-1: FORCE SYSTEMS AND

Introduction to Engineering Mechanics — basic concepts and idealizations (particle, rigid body, continuum); Force systems: coplanar and non-coplanar, concurrent and non-concurrent forces; Resolution and composition of forces; Principle of transmissibility; Moment of a force; Varignon's theorem; Couples; Free body diagrams (FBD) of engineering components; Conditions of equilibrium; two-force and three-force members; Equilibrium of coplanar force systems — graphical and analytical methods.

UNIT-2:

EQUILIBRIUM OF RIGID BODIES: Conditions of equilibrium; two-force and three-force members; Equilibrium of coplanar force systems — graphical and analytical methods.

FRICTION: Laws of friction; coefficient of friction; angle of friction and angle of repose; Friction in wedges, ladders, and belt drives.

UNIT-3:

CENTROIDS: Centroid of plane figures and composite areas — first principles and standard formulae; Centroid of composite bodies (lines, areas, volumes).

MOMENT OF INERTIA: Moment of inertia of plane areas; parallel axis and perpendicular axis theorems; Radius of gyration; moment of inertia of composite sections.

UNIT-4: KINEMATICS OF PARTICLES

Rectilinear motion: displacement, velocity, and acceleration; Motion under uniform and variable acceleration; Curvilinear motion: rectangular and normal-tangential components; Projectile motion; Relative motion of particles; Motion (s–t, v–t, a–t) diagrams and their interpretation.

UNIT-5: KINETICS OF PARTICLES

Newton's second law of motion; equations of motion for particles; D'Alembert's principle; Work-energy principle for particles; conservation of energy; Impulse-momentum principle; conservation of momentum; Direct central impact; coefficient of restitution

Learning Resources:

Text Books:

1. Hibbeler, R. C. (2016). Engineering mechanics: Statics and dynamics (14th ed.). Pearson.
2. Shames, I. H., & Rao, G. K. M. (2006). Engineering mechanics: Statics and dynamics (4th ed.). Pearson Education.

Reference Books:

1. Timoshenko, S., & Young, D. H. (1956). Engineering mechanics. McGraw-Hill.
2. Rajasekaran, S., & Sankarasubramanian, G. (2015). Engineering mechanics: Statics and dynamics (3rd ed.). Vikas Publishing House.
3. Bhavikatti, S. S. (2016). Engineering mechanics (4th ed.). New Age International Publishers.

Web Resources:

a. National Programme on Technology Enhanced Learning. (n.d.). Engineering mechanics [Video lecture series]. NPTEL. https://nptel.ac.in
b. Massachusetts Institute of Technology. (n.d.). Engineering mechanics I. MIT OpenCourseWare. https://ocw.mit.edu
c. Khan Academy. (n.d.). Forces and Newton's laws of motion. https://www.khanacademy.org

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CATEGORY ESC	ENGINEERING WORKSHOP PRACTICE	L	T	P	C
COURSE CODE: A2620301		0	0	3	1.5

Pre-requisites: Nil

Course Objectives: ***The course aims to***

1. Familiarize students with workshop tools, equipment, materials, and safety practices used in basic engineering activities.
2. Develop hands – on skills in wood working, sheet metal working, fitting, foundry, welding and plumbing operations.
3. Provide practical experience in basic electrical wiring, soldering, and electrical circuit connections.
4. Introduce students to basic tinkering, sensors, actuators, microcontrollers and IoT applications.
5. Develop students' practical problem-solving, fabrication, assembly, maintenance, and troubleshooting skills through hands-on activities.

Course Outcomes: *At the end of the course, the student will be able to:*

COs	Course Outcome Statement	K level
CO1	Apply safety practices and identify appropriate workshop tools, equipment, materials and measuring instruments for basic engineering activities.	K3
CO2	Perform basic fabrication and manufacturing operations using carpentry, sheet metal, fitting, foundry, welding and plumbing techniques.	K3
CO3	Apply workshop practices for the assembly, disassembly, maintenance and repair of simple engineering components and systems.	K3
CO4	Perform basic electrical wiring, circuit connections, soldering, and testing using appropriate electrical practices.	K3
CO5	Develop simple sensors, actuator, microcontroller and IoT-based applications through hands-on tinkering and experimentation.	K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	–	2	1	1	3	2	1	–		
CO2	3	3	3	2	2	1	2	3	3	2	2		
CO3	3	3	3	2	2	2	2	3	3	2	2		
CO4	3	3	2	2	3	1	1	3	2	2	2		
CO5	3	3	3	2	3	2	2	3	3	2	2		

1- Low, 2 - Moderate, 3 - High

SYLLABUS

(*Students shall perform* ***any 16 experiments*** *as prescribed by the department, covering all the workshop trades.)*

1. **Demonstration**: Safety practices and precautions to be observed in workshop.

2. **Wood Working:** Familiarity with different types of wood and tools used in wood working and make following joints.

   a) Half– Lap joint b) Mortise and Tenon joint c) Corner Dove tail joint or Bridle joint.

3. **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

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a)V-fit b) Dove tail fit c)Semi-circular fit

5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two – way switch c) Godown lighting d) Soldering of wires.

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

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

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

9. **Assembly and disassembly of Two – wheeler electric vehicle.**

10. **Tinkering Lab experiments:**
    a) Build and demonstrate automatic street light using LDR.
    b) Simulate the AURDINO LED blinking activity in Tinker cad
    c) Interface a basic sensor and actuator with a micro controller.

Learning Resources:

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S.Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol.I by S.K.Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition.
2. Workshop Practice by H.S.Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan,2021-22.
4. https://aim.gov.in/pdf/equipment-manual-pdf.pdf- For Tinkering Lab

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CATEGORY ESC	ENGINEERING MECHANICS LAB	L	T	P	C
COURSE CODE: A2620302		0	0	3	1.5

Pre-requisites: Nil

Course Objectives: ***The course aims to***

1.	Understand the basic principles and laws of engineering mechanics through experiments.
2.	Analyze different force systems and equilibrium conditions using suitable apparatus.
3.	Determine friction, centre of gravity, and moment of inertia through practical experiments.
4.	Apply the principles of mechanics to beams, pulleys, levers, and rotating systems.
5.	Develop skills in observation, measurement, calculation, and interpretation of experimental results.

Course Outcomes: *At the end of the course, the student will be able to:*

COs	Course Outcome Statement	K level
CO1	Verify the laws of parallelogram, triangle, and polygon of forces and analyze force systems acting on particles in equilibrium.	**K3**
CO2	Determine the coefficient of static and rolling friction and analyze the equilibrium conditions of rigid bodies subjected to different force systems.	**K3**
CO3	Determine the centre of gravity of different plane laminae and apply equilibrium principles to simply supported beams and pulley systems.	**K3**
CO4	Determine acceleration due to gravity and moments of inertia of a compound pendulum and flywheel using suitable experimental techniques.	**K3**
CO5	Verify the law of moments using rotation disc and bell crank lever apparatus, interpret experimental observations, and report results with appropriate calculations and conclusions.	**K4**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	2	–	–	2	2	2	–		
CO2	3	3	3	3	2	–	–	2	2	2	–		
CO3	3	3	3	3	2	–	–	2	2	2	–		
CO4	3	3	3	3	2	2	–	3	3	2	2		
CO5	3	3	2	3	2	–	–	2	2	2	–		
1 - Low, 2 - Moderate, 3 - High													

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar- concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.

6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. S.Timoshenko, D.H.Young, J.V.Rao, S.Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

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CATEGORY ESC	DESIGN THINKING AND INNOVATION (Common to CSE and Allied Branches of Engineering)	L	T	P	C
COURSE CODE: A2620501		0	1	3	2.5

Pre-requisites: NIL

Course Objectives:

1. Introduce students to the principles, mindset and methodologies of **Design Thinking and human-centered problem solving**.
2. Develop students' ability to **observe, empathize, analyze user needs and formulate well-Defined engineering and societal problems**.
3. Develop students' **creative and innovative thinking abilities** through systematic ideation, concept generation and evaluation techniques.
4. Enable students to **develop, prototype, test and iteratively improve solutions** Using user feedback and appropriate physical/digital tools.
5. Develop students' ability to **identify innovation opportunities, create value propositions, understand basic IPR and communicate innovative solutions effectively**.

Course Outcomes: ***At the end of the course, the student will be able to:***

COs	Course Outcome Statement	K level
CO1	Explain the principles, processes and mindset of Design Thinking for engineering problem-Solving and innovation	K2
CO2	Apply empathy, observation and problem- Framing techniques to identify user needs and define engineering problems.	K3
CO3	Apply creative and systematic ideation techniques to generate and select innovative solution concepts.	K3
CO4	Analyze solution concepts and proto types using user feedback and appropriate design criteria for iterative improvement.	K4
CO5	Analyze the innovation potential of solutions considering value proposition, feasibility, Sustainability, societal impact and basic IPR aspects.	K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	–	–	1	–	–	1	1	2				
CO2	2	3	3	1	1	3	2	1	2	2	2				
CO3	1	2	3	1	2	1	1	–	3	2	2				
CO4	3	3	3	2	3	2	2	1	3	2	2				
CO5	1	2	3	1	2	3	3	2	2	3	3				
1 - Low, 2 - Moderate, 3 - High															

UNIT I—Design Thinking Foundations & Empathy

Introduction to Design Thinking ; Design thinking mindset and principles ; Design thinking vs. conventional engineering problem-solving ; Human-centered design ; Five-stage design thinking process ; Creativity, curiosity and observation; Understanding users and stake holders; Empathy and user research; Interviews, observation and contextual inquiry ; Empathy mapping ; Personas and user journeys ; Identifying explicit and latent/unarticulated needs ; Ethical considerations in user research

Practical Activities

- Observation of a real – life problem
- Conducting user interviews
- Preparing an empathy map
- Developing a persona
- Preparing a user journey map

Unit Outcome Students will be able to **understand users, identify their needs and translate observations into meaningful design opportunities**.

UNIT II—Problem Definition, Analysis & Opportunity Identification

From observations to insights; Data synthesis and affinity mapping; Identifying patterns and pain points; Problem statements ; Point-of-View (POV) statements ; "How Might We" (HMW) questions ; Stakeholder mapping ; 5 Whys and root-cause analysis ; Problem prioritization ; Need–Opportunity mapping ; Problem validation ; Design constraints and specifications ; Social, environmental and sustainability considerations ; Identifying opportunities for innovation

Practical Activities

- Affinity mapping of interview data.
- Develop three alternative problem statements.
- Prepare POV and HMW statements
- Stake holder map
- Root-cause analysis
- Select and validate one problem/opportunity

Unit Outcome

Students will be able to **analyze user research, identify root causes, frame well – defined problems and recognize opportunities for innovative solutions**.

UNIT III— Creativity, Ideation & Concept Development

Creativity and innovation mindset; Divergent and convergent thinking ; Brainstorming and brain writing ; SCAMPER; Mind mapping ; Reverse brain storming; Analogical thinking; Biomimicry ; Lateral thinking; Forced connections; Morphological analysis; TRIZ — basic principles; Individual and collaborative ideation; AI-assisted ideation: opportunities and limitations; Idea clustering and screening; Impact–feasibility matrix; Concept selection Design criteria and decision matrix.

Practical Activities

- Generate 20–30ideasforaselected problem
- SCAMPER exercise
- Brain writing exercise
- Biomimicry-based ideation
- AI-assisted idea generation and critical evaluation
- Prepare an idea – selection matrix
- Select the top 2–3 concepts

Unit Outcome

Students will be able to **generate diverse solution concepts using creative techniques and systematically select promising ideas based on defined criteria**.

UNIT IV— Prototyping, Experimentation & Validation

Concept development; Prototype mindset; Types of prototypes: Paper prototype, Physical prototype, Digital prototype, Storyboard, Role-play, Service prototype; Low-fidelity and high-fidelity prototypes; Rapid prototyping Fail fast, learn fast"; Minimum Viable Prototype (MVP); Design experimentation; Prototype evaluation; User testing ; Think-aloud method ; Feedback collection ; Usability and functionality testing; Iterative design ; Design critique ; Documentation of iterations ; Use of CAD, simulation and AI-assisted visualization tools.

Practical Activities

- Develop a low-fidelity prototype
- Prepare a storyboard
- Build a physical/digital prototype
- Conduct user testing
- Collect structured feedback
- Modify the prototype
- Prepare an iteration log

UNIT V—Innovation, Value Creation & Communication

Innovation: meaning, characteristics and importance: Invention vs. innovation; Incremental, disruptive and radical innovation; Product, process, service and social innovation; Technology – driven vs need - driven innovation; Sustainable and frugal innovation ; Innovation opportunities and emerging technologies ; From prototype to innovation ; Desirability, feasibility and viability ; Value Proposition ; Value Proposition Canvas ; Introduction to Business Model Canvas; Customer segments and stake holder value; Innovation validation; Market / user validation; Intellectual Property Rights — introduction; Patents, copyright, trademarks and design protection; Responsible innovation; Inclusive and sustainable innovation; Innovation ecosystem and entrepreneurship; Communicating innovative ideas; Innovation pitch.

Practical Activities

1. Classify existing products / services as incremental, disruptive or radical innovations.
2. Identify three innovation opportunities from a campus / community problem.
3. Prepare a **Value Proposition Canvas**.
4. Validate the proposed innovation with potential users.
5. Prepare an introductory **Business Model Canvas**.
6. Identify possible IPR protection.
7. Prepare and deliver a **3 – minute Innovation Pitch**.

Learning Resources:

Text book:

1. Chandan Adhikari, Prabir Kumar Das & Tanay Pramanik, Textbook of Design Thinking and Innovation,S.Chand Publishing, 2026.
2. Shalini Rahul Tiwari & Rohit Rajendra Swarup, Design Thinking: A Comprehensive Textbook, Wiley India, 2024

Reference Books:

1. Soni, Pavan, Design Your Thinking: The Mindsets, Tool sets and Skill Sets for Creative Problem-Solving, Penguin Random House India.
2. Jauhari, Vinnie & Sudhanshu Bhushan, Innovation Management, Oxford University Press India.

Web Resources:

1. Atal Innovation Mission, NITI Aayog – Innovation and Design Thinking Resources. https://aim.gov.in/ Institution's Innovation Council (IIC), Ministry of Education, Government of India, https://iic.mic.gov.in/
2. Startup India, Government of India–Innovation and Entrepreneurship Ecosystem, https://www.startupindia.gov.in/
3. National Innovation Foundation – India – Grass roots and Frugal Innovation, https://nif.org.in/
4. Stanford d.school – Design Thinking Bootleg and Design Thinking Resources, https://dschool.stanford.edu/resources/design-thinking-bootleg
5. IDEO.org–Human-Centered Design and Social Innovation Resources , https://www.ideo.org/
6. IDEOU–Design Thinking and Innovation Resources, https://www.ideou.com/pages/design-thinking
7. NPTEL–Online Courses on Design, Innovation, Creativity and Entrepreneurship, https://nptel.ac.in/
8. SWAYAM–Online Courses on Innovation, Entrepreneurship and Design Thinking, https://swayam.gov.in/