G. Pullaiah College of Engineering and Technology

(Autonomous)

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

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

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS
GPCET – R26

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

Preliminary Definitions and Nomenclature

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. **Award of the Degree**

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

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

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

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

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

II. Registering for Honors is optional.

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

C) Award of B.Tech. degree with Minors

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

II. Registering for Minors is optional.

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

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

3. **Admissions**

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

4. **Program related terms**

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

Credit Definition:

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

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

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

5. Semester/Credits:

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

6. Structure of the Undergraduate Programme

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

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

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

7. Course Classification:

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

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

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

8. Programme Pattern

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

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

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

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

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

9. Evaluation Process

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

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

Theory Courses

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

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

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

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

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

a) Continuous Internal Evaluation

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

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

Note:

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

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

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

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

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

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

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

For Example:

Marks obtained in first mid: Absent

Absent Marks obtained in second mid:25

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

b) End Examination Evaluation:

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

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

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

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

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

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

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

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

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

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

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

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

Procedure: 20 Marks

Experimental work & Results: 30 marks

Viva voce: 20 marks.

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

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

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

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

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

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

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

NOTE

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

10. Skill Oriented Courses

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

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

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

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

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

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

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

11. Massive Open Online Courses (MOOCs):

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the Institute. Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12 Credit Transfer Policy

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

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

13 Academic Bank of Credits (ABC)

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

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

14 Mandatory Internships

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

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

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

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

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

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

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

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

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

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

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

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

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

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

16 Guidelines for offering a Minor

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

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

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

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

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

17 Guidelines for offering Honors

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

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

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

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

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

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

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

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

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

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

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

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

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

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

courses completed by them.

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

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

Enrolment into Honors:

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

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

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

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

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

Registration for Honors/Minors:

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

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

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

Failure & Supplementary Examination Procedure for Honors/Minors Courses:

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

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

18 Attendance Requirements:

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

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

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

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

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

vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for re admission into the same class.

vii) If the learning is carried out in blended mode (both offline & online), then the total attendance

of the student shall be calculated considering the offline and online attendance of the student.

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

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

19 Promotion Rules:

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

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

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

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

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

20 Grading:

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

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

Structure of Grading of Academic Performance

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

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

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

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

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

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

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

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

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

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

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

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

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

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

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

Award of Class:

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

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

Both CGPA and Marks shall be given in marks memos.

21 With–holding of Results

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

22 Multiple Entry / Exit Option

(a) Exit Policy:

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

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

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

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

(b) Entry Policy:

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

Note: The Institution/University shall resolve any issues that may arise in the implementation of MultipleEntry and Exit policies from time to time and shall review the policies in the light of periodic

changes brought by UGC, AICTE and State government.

23 Gap Year Concept:

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

24 Transitory Regulations

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

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

25 Minimum Instruction Days:

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

26 Medium of Instruction:

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

27 Student Transfers:

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

28 General Instructions:

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

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ACADEMIC REGULATIONS (R26)

FOR B.TECH.(LATERAL ENTRY SCHEME)

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

1. Award of the Degree

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

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

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

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

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

(ii) Registering for Honors is optional.

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

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

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

(ii) Registering for Minors is optional.

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

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

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

4. Course Pattern

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

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

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

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

RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

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

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

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

Malpractices identified by squad or special invigilators

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

Note: -

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

PROGRAMME CURRICULUM STRUCTURE UNDER R26 REGULATIONS

B. TECH – MECHANICAL ENGINEERING

INDUCTION PROGRAM

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL
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I SEMESTER (I YEAR)

Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT101	Linear Algebra and Calculus	BS	3	0	2	0	4	30	70	100
26PHY103	Physics for Mechanical Systems	BS	3	0	0	0	3	30	70	100
26CSE101	Computational Thinking and Problem Solving with Python	ES	3	0	0	0	3	30	70	100
26ENG101	Communicative English	HM	2	0	0	0	2	30	70	100
26CAI101	AI Tools and Applications	ES	1	0	4	0	3	30	70	100
26PHY104	Physics for Mechanical Systems Lab	BS	0	0	0	3	1.5	30	70	100
26CSE102	Computational Thinking and Problem Solving with Python Lab	ES	0	0	0	3	1.5	30	70	100
26ENG102	Communicative English Lab	HM	0	0	0	2	1	30	70	100
26HSM103	Health and Wellness, Yoga and Sports	HM	0	0	0	1	0.5	-	100	100
26CSE103	Cybersecurity Awareness for Engineers	MC	2	0	0	0	0	100*	-	100*
		TOTAL	14	0	6	9	19.5	240	660	900

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

II SEMESTER (I YEAR)

Course Code	Title of the Course	Category	Periods perWeek				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT201	Differential Equations & Vector Calculus	BS	3	0	2	0	4	30	70	100
26CHE203	Applied Chemistry for Mechanical Engineers	BS	3	0	0	0	3	30	70	100
26MEC101	Engineering Graphics	ES	1	0	4	0	3	30	70	100
26MEC201	Engineering Mechanics	PC	3	0	0	0	3	30	70	100
26HSM101	Design Thinking	HM	1	0	4	0	3	30	70	100
26MEC202	Basic Simulation Lab	PC	0	0	0	2	1	30	70	100
26CHE204	Applied Chemistry for Mechanical Engineers Lab	BS	0	0	0	3	1.5	30	70	100
26MEC102	Engineering Workshop	ES	0	0	0	3	1.5	30	70	100
26HSM102	NSS/NCC/Scouts & Guides/ Community Service	HM	0	0	0	1	0.5	-	100	100
		TOTAL	11	0	10	09	20.5	240	660	900

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

III SEMESTER (II YEAR)

Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Complex Variables and Probability Theory	BS	3	0	0	0	3	30	70	100
	Universal Human Values– Understanding Harmony & Ethical Human Conduct	HM	3	1	0	0	3	30	70	100
	Managerial Economics and Financial Analysis	HM	2	0	0	0	2	30	70	100
	Basic Electrical and Electronics Engineering	ES	3	0	0	0	3	30	70	100
	Material Science and Metallurgy	PC	2	0	2	0	3	30	70	100
	Mechanics of Solids	PC	2	0	2	0	3	30	70	100
	Basic Electrical and Electronics Engineering Lab	ES	0	0	0	2	1	30	70	100
	Engineering Mechanics Lab	PC	0	0	0	3	1.5	30	70	100
	Mechanics of Solids And Material Science Lab	PC	0	0	0	3	1.5	30	70	100
	Computer Aided Machine Drawing	SEC	1	0	0	2	2	30	70	100
	Environmental Science (Audit)	MC	2	0	0	0	-	100*	-	100*
		TOTAL	**18**	**0**	**4**	**10**	**23**	**300**	**700**	**1000**

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

IV SEMESTER (II YEAR)

Course Code	Title of the Course	Category	Periods perWeek				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
	Biology for Engineers	HM	2	0	0	0	2	30	70	100
	Sustainability and Green Engineering	ES	1	0	2	0	2	30	70	100
	Fluid Mechanics and Hydraulic Machinery	PC	2	0	2	0	3	30	70	100
	Manufacturing Processes	PC	2	0	2	0	3	30	70	100
	Kinematics of Machinery	PC	2	0	2	0	3	30	70	100
	Thermodynamics	PC	2	0	2	0	3	30	70	100
	Fluid Mechanics and Hydraulic Machinery Lab	PC	0	0	0	3	1.5	30	70	100
	Manufacturing Processes Lab	PC	0	0	0	3	1.5	30	70	100
	Embedded Systems and IoT Lab	SEC	1	0	0	2	2	30	70	100
	Technical Paper Writing & IPR	MC	2	0	0	0	0	100*	-	100*
		TOTAL	**14**	**0**	**10**	**08**	**21**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation after II year II semester										

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

V SEMESTER (III YEAR)

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

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

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

VI SEMESTER (III YEAR)

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

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

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

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

I SEMESTER (I YEAR)										
Course Code	Title of the Course	Category	Periods per Week				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT101	Linear Algebra and Calculus	BS	3	0	2	0	4	30	70	100
26PHY103	Physics for Mechanical Systems	BS	3	0	0	0	3	30	70	100
26CSE101	Computational Thinking and Problem Solving with Python	ES	3	0	0	0	3	30	70	100
26ENG101	Communicative English	HM	2	0	0	0	2	30	70	100
26CAI101	AI Tools and Applications	ES	1	0	4	0	3	30	70	100
26PHY104	Physics for Mechanical Systems Lab	BS	0	0	0	3	1.5	30	70	100
26CSE102	Computational Thinking and Problem Solving with Python Lab	ES	0	0	0	3	1.5	30	70	100
26ENG102	Communicative English Lab	HM	0	0	0	2	1	30	70	100
26HSM103	Health and Wellness, Yoga and Sports	HM	0	0	0	1	0.5	-	100	100
26CSE103	Cybersecurity Awareness for Engineers	MC	2	0	0	0	0	100*	-	100*
		TOTAL	14	0	6	9	19.5	240	660	900

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

LINEAR ALGEBRA AND CALCULUS

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

1. Course Objectives

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

Course Pre/corequisites

There are no pre/corequisites

2. Course Outcomes (COs)

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

CO1 Apply matrix algebra techniques to Solve systems of linear equations using matrix algebra, elimination techniques, and iterative methods, while leveraging computational tools for large-scale systems.

CO2 Analyze eigenvalue problems, diagonalization, and quadratic forms to interpret linear transformations and engineering systems.

CO3 Apply mean value theorems and polynomial approximations (Taylor and Maclaurin series) to evaluate functions and estimate errors.

CO4 Analyze multivariable functions using partial derivatives, Jacobians and optimization techniques.

CO5 Evaluate areas, volumes, and coordinate transformations using multiple integrals in engineering contexts.

3. Course Syllabus

UNIT I: Matrix Algebra and Linear Systems

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

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

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

UNIT II: Eigenvalues, Eigenvectors, Diagonalization & Quadratic Forms

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

AI Integration: AI-assisted eigenvalue computation and verification; Python/SciPy visualization of eigenmodes and quadratic surfaces; use of AI tools to explain diagonalization and matrix classification; numerical checking of Cayley-Hamilton theorem.
Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib); SymPy; GNU Octave; Google Colab.

UNIT III: Single Variable Calculus and Series Expansions

Core Content: Rolle's theorem; Lagrange's mean value theorem; Cauchy's mean value theorem; Taylor's and Maclaurin's series with remainder; approximation of functions; error estimation.
AI Integration: SymPy-based Taylor and Maclaurin expansion generation; plotting truncation error and convergence; AI-supported derivation checking for mean value theorems.
Free/Open-Source AI Tools: Python (SymPy, NumPy, Matplotlib); Google Colab; Jupyter Notebook; WolframAlpha free tier for verification.

UNIT IV: Multivariable Differentiation and Optimization

Core Content: Functions of several variables; limits and continuity; partial derivatives; higher order partial derivatives; total derivative; chain rule; Jacobians; functional dependence; Taylor expansion of two-variable functions; maxima and minima; second derivative test; Lagrange multipliers and constrained optimization.
AI Integration: Series expansion visualization using Python; AI-assisted Jacobian computation and verification; constrained optimization using SciPy; use of AI tools to interpret saddle points, extrema, and optimization constraints.
Free/Open-Source AI Tools: Python (NumPy, SciPy, SymPy, Matplotlib); Google Colab; Jupyter Notebook; SciPy optimize module.

UNIT V: Multiple Integrals and Coordinate Transformations

Core Content: Double integrals; evaluation over type I and type II regions; change of order of integration; triple integrals; change of variables; polar, cylindrical and spherical coordinates; area and volume computation.
AI Integration: Numerical evaluation of double and triple integrals using SciPy; 2D and 3D region visualization; AI-assisted generation of integration code; interpreting Jacobian as geometric scaling factor in transformed coordinates.
Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib); Google Colab; SymPy; Jupyter Notebook; 3D plotting tools.

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

1. NPTEL: Linear Algebra – https://nptel.ac.in
2. MIT OpenCourseWare – Linear Algebra: https://ocw.mit.edu
3. MIT OpenCourseWare – Multivariable Calculus: https://ocw.mit.edu
4. Python SymPy Documentation: https://docs.sympy.org
5. Google Colab for Python: https://colab.research.google.com
6. SciPy Documentation: https://docs.scipy.org
7. NumPy Documentation: https://numpy.org/doc

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

PHYSICS FOR MECHANICAL SYSTEMS

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

1. Course Objectives

- To provide students with a strong foundation in wave optics concepts such as interference, diffraction and polarization along with their applications in optical measurements, dimensional inspection and basic AI-assisted image and fringe pattern analysis techniques.
- To equip students the basic principles of quantum mechanics and quantum computing, including quantum states, tunneling, superposition and secure communication with introductory AI-assisted quantum simulations and visualization tools.
- To introduce the fundamentals of crystallography and X-ray diffraction methods for understanding crystal structures, phase identification and material characterization using simple AI-assisted data analysis approaches.
- To familiarize students with oscillations, vibration control systems, lasers and precision engineering applications along with basic AI-assisted monitoring, predictive maintenance and intelligent control concepts used in modern industries.
- To impart knowledge on the principles of ultrasonics and non-destructive testing methods for defect detection, quality inspection and structural analysis using simple AI-assisted signal interpretation and automated inspection techniques.

Prerequisites: Engineering Mechanics, Engineering Mathematics, Basic Physics

2. Course Outcomes (COs)

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

CO1 Examine the principles of interference, diffraction and polarization and utilise basic AI-assisted optical analysis techniques in engineering applications.

CO2 Interpret the concepts of quantum mechanics and quantum computing and apply basic AI-assisted quantum simulation techniques for secure communication systems.

CO3 Analyze crystal structures, diffraction patterns and material properties using X-ray diffraction methods and basic AI-assisted material characterization tools.

CO4 Analyze oscillatory systems, vibration control mechanisms and laser-based metrology techniques using basic AI-assisted monitoring and predictive approaches.

CO5 Evaluate ultrasonic testing and non-destructive testing methods for defect identification and quality assessment using basic AI-assisted signal analysis techniques.

3. Course Syllabus

UNIT I: Applied Wave Optics

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

Diffraction and Optical Surveying: Introduction to diffraction; Fresnel and Fraunhofer diffraction. Fraunhofer diffraction due to single slit and double slit, Diffraction Grating, Dispersive power and Resolving power of Grating.

Application: 3D Scanning for Dimensional Inspection of Casted Parts.

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

AI Integration:

AI-integrated holographic interferometry for micro-deformation analysis. Python-based fringe pattern analysis using image processing (OpenCV).

Free/Open-Source AI Tools:

Python (NumPy, SciPy, Matplotlib and scikit-learn).

UNIT II: Introduction to Quantum Mechanics & Quantum Computing

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

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

AI Integration: AI-assisted quantum circuit simulation using IBM Qiskit (free). Python-based visualization of wave functions and quantum probability densities.

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

UNIT III: Crystallography and AI-Driven Material Engineering

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Crystal systems, Bravais Lattices – – Coordination number - Packing fraction of SC, BCC & FCC - Miller indices – Separation between successive (h k l) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – Crystal structure determination by Laue's method. Application:XRD Pattern Analysis for Phase Identification, Determination of Crystal Structure of Metals and Alloys

AI Integration:

AI-assisted XRD pattern analysis for phase identification and crystal structure determination. ML-based classification of diffraction patterns using scikit-learn.

Free/Open-Source AI Tools:

Python (NumPy, SciPy, Matplotlib and scikit-learn).

UNIT IV: Oscillations, Vibration Control and Laser-Based Metrology

Introduction to oscillations and oscillations of springs. Series and parallel combinations of springs in Suspension Systems, Stiffness factor and its physical significance, Theory of damped oscillations (Over, Under and Critical damping – all qualitative). Forced oscillations (qualitative) and Resonance; Sharpness of resonance and Quality factor (Q). Applications (Qualitative): shock absorbers, noise, and vibration reduction.

Lasers and Precision Engineering: Principles of Absorption, Spontaneous and Stimulated Emission, Population Inversion. Construction and working of He-Ne Laser and Nd-YAG Laser. Applications (qualitative only): Role of high-power lasers in CNC Laser Cutting and Welding.

AI Integration: AI-Assisted Adaptive Suspension System for EVs, AI-Based Vibration Monitoring and Predictive Maintenance.

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

UNIT V: Ultrasonics and Non-Destructive Testing (NDT)

Introduction to ultrasonics; Production of ultrasonics: Piezoelectric method and Magnetostriction method, Detection of ultrasonics: Kundt's tube and Quartz crystal methods. Applications: Use of Ultrasonic Flaw Detectors to identify internal cracks, voids and thickness variations in cast and forged engine components.

Non-Destructive Testing (NDT): Introduction, need and advantages in mechanical engineering structures, Basic inspection methods: Visual inspection and AI-based drone inspections for inaccessible materials (qualitative). Liquid penetrant testing: basic principle for detecting surface defects in steel. Applications: Detecting surface and sub-surface defects, sorting alloys and measuring coating thickness on automotive parts.

AI Integration: AI-recognition in abnormal echo patterns,AI-assistedadditional reflections and frequency distortions.

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

4. Books and Materials

Textbook (s)

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

Reference Book (S)

1. B. K. Pandey & S. Chaturvedi, Engineering Physics, Cengage Learning, 2021.
2. Shatendra Sharma &Jyotsna Sharma, Engineering Physics, Pearson, 2018.
3. Sanjay D. Jain, D. Sahasrabudhe & Girish, Engineering Physics, Universities Press, 2010.
4. M. R. Srinivasan, Engineering Physics, New Age International, 2009.
5. S. O. Pillai, Solid State Physics, New Age International.
6. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S. Chand.

Online Learning Resources

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

Recommended Free & Open-Source AI/Computational Tools

- Python (NumPy, SciPy, OpenCV, Matplotlib) – FREE on Google Colab for wave optics and signal analysis
- TensorFlow / Keras (free, open-source) – For crack and defect detection CNNs on
- Google Colab
- scikit-learn (free, open-source) – For anomaly detection in vibration and NDT data
- IBM Qiskit (free, open-source) – For quantum computing simulations on Google Colab
- OpenCV (free, open-source) – For image processing in visual inspection and interferometry
- PhET Interactive Simulations (free) – For wave optics, quantum mechanics and oscillations

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

COMPUTATIONAL THINKING AND PROBLEM SOLVING WITH PYTHON

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

1. Course Objectives

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

Course Pre/corequisites

There are no course pre/corequisites

2. Course Outcomes (COs)

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

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

3. Course Syllabus

UNIT I: Computational Thinking and Programming Basics

Core Content: Computational thinking: characteristics, problem-solving strategies, steps in problem solving; algorithms — definition and properties; flowcharts — symbols and construction; pseudocode — writing and conversion; abstraction, decomposition, pattern recognition, algorithm efficiency basics.

Introduction to Python: installation and execution environment; variables, identifiers, keywords; data types, type conversion; input and output statements; expressions and operators — arithmetic, relational, logical, assignment; operator precedence.

AI Integration: Use Flowgorithm to design and simulate algorithms (e.g., largest of 3 numbers); draw flowcharts using Lucidchart; use Algorithm Visualizer to trace algorithm execution; use ChatGPT to convert pseudocode to Python and verify output.

UNIT II: Decision Making and Looping

Core Content: Decision control statements: Boolean expressions; if, if-else, if-elif-else, nested if; conditional expressions (ternary operator).

Looping statements: while loop, for loop, iteration techniques, nested loops, infinite loops; loop control — break, continue, pass; else with loops.

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

AI Integration: Use Python Tutor to visualize if-else and loop execution step by step; use Thonny to debug loop-based programs; use Replit Decision control statements: Boolean expressions; if, if-else, if-elif-else, nested if; conditional expressions (ternary operator).

Looping statements: while loop, for loop, iteration techniques, nested loops, infinite loops; loop

control — break, continue, pass; else with loops.
Practical problem solving: prime number check, pattern programs using nested loops, menu-driven programs using control statements.

UNIT III: Strings and Data Structures

Core Content: Strings: representation, indexing, slicing, operations, built-in functions and methods. Lists: creation, indexing and slicing, operations, functions, methods, nested lists.
Tuples: creation, operations, packing and unpacking. Sets: creation, set operations — union, intersection, difference; frozen sets.
AI Integration: Use NLTK and TextBlob to perform text analysis (sentiment, word frequency) on strings; use Pandas and NumPy for list and array operations; use ChatGPT to explain string slicing and list comprehensions with concrete examples.

UNIT IV: Functions and Problem Solving

Core Content: Dictionaries: creation, operations, methods; dictionary-based applications.
Functions: built-in and user-defined functions; function definition and calling; arguments — positional, keyword, default, variable-length; scope of variables (local and global).
Recursion: recursive functions — factorial, Fibonacci; lambda functions (anonymous functions); applications of functions in problem solving
AI Integration: Use Jupyter Notebook for interactive function experiments; use SymPy for symbolic mathematical expressions; use PyCharm for modular program development; use ChatGPT to trace recursive function calls step by step.

UNIT V: File Handling, Exception Handling, AND OOP

Core Content: Modules and packages: creating and importing modules; standard library modules. File handling: opening, reading, writing, and closing files; file modes; working with text files; processing CSV and Excel files. Exception handling: types of errors (syntax, runtime, logical); try, except, finally blocks; raising exceptions. Introduction to OOP: classes, objects, attributes, methods, constructors, self keyword; basic applications of OOP in Python)
AI Integration: Use Pandas and OpenPyXL to read and write CSV/Excel files; use Pytest for testing exception handling; use ChatGPT to explain OOP class design with real-world examples; use Django for a simple mini web application as a capstone project.

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

COMMUNICATIVE ENGLISH

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

1. Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

CO1 Apply fundamental rules of English grammar, syntax, and communication dynamics, utilizing AI-driven tools to enhance language accuracy, real-time feedback, and vocabulary acquisition.

CO2 Demonstrate effective oral communication, active listening, and persuasive presentation skills in group discussions, debates, and public speaking, while leveraging AI tools for real-time speech analysis and dynamic visual content creation.

CO3 Apply diverse reading strategies, expand academic vocabulary, and draft structured written texts—ranging from paragraphs to creative reviews—while utilizing AI tools to analyze readability, optimize sentence structure, and generate content outlines.

CO4 Construct professional workplace communications—including business emails, short reports, resumes, and digital profiles—while leveraging AI tools to refine tone, optimize for ATS filters, and streamline document structure.

CO5 Evaluate the role, benefits, and ethical implications of Artificial Intelligence in modern communication, using AI tools responsibility for language learning, cross-cultural translation, content creation, and e-portfolio development while adhering to academic integrity.

3. Course Syllabus

UNIT I: Foundations of English Communication

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

AI Integration: Grammar explanation, error identification, and instant Q&A on language rules, Real-time grammar, spelling, and punctuation correction with detailed explanations, Phonetics

practice – voice recording for pronunciation and intonation feedback, Word-of-the-day, etymology, and interactive vocabulary quizzes.

Free/Open-Source AI Tools: Grammarly (free); ChatGPT / Gemini (free tiers); Google Speech-to-Text (free); Merriam-Webster Vocabulary Builder (free)

UNIT II: Listening and Speaking Skills

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

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

Free/Open-Source AI Tools: Gamma.app (free); Orai AI Speech Coach (free); Otter.ai (free tier); Canva AI (free)

UNIT III: Reading Comprehension & Writing Skills

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

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

Free/Open-Source AI Tools: QuillBot (free); Hemingway Editor (free online); ChatGPT (free); Rewordify (free).

UNIT IV: Professional & Business Communication

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

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

Free/Open-Source AI Tools: ChatGPT (free); Kickresume (free tier); Grammarly (free); Notion AI (free tier).

UNIT V: Use of AI in Language Learning

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

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

Free/Open-Source AI Tools: Copyleaks / Turnitin (institutional access); DeepL Translator (free); Wix (free); Adobe Portfolio (free for students); ChatGPT / Gemini (free tiers).

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

AI TOOLS & APPLICATIONS

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

1. Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

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

3. Course Syllabus

UNIT I: UNDERSTANDING AI AND AI FOR DOCUMENTS AND PRESENTATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

UNIT IV: AI ACROSS ENGINEERING DISCIPLINES

Core Content: AI in Mechanical Engineering: generative design in CAD (Autodesk Fusion 360 — AI-optimized structures for weight and load); predictive maintenance using sensor data and ML;

AI-assisted FEA simulation; manufacturing process optimization; digital twins.

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

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

AI in Computer Science and allied branches: GitHub Copilot for code generation, explanation, and review; AI-powered testing (Testim, Selenium AI); AI in cybersecurity — anomaly detection and intrusion detection; no-code/low-code platforms (Bubble, Glide, Webflow AI); AI for data science (Jupyter AI, DataRobot).

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

UNIT V: RESPONSIBLE AI, ETHICS, AND CAPSTONE PROJECT

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

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

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

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

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

4. Books and Materials

Textbook (s)

1. Ethan Mollick, Co-Intelligence: Living and Working with AI, Portfolio/Penguin, 2024.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2020.
3. Reid Blackman, Ethical Machines, Harvard Business Review Press, 2022.

Reference Book(s)

1. Google – Fundamentals of AI – grow.google/intl/en_in/ai-learning-resources
2. Microsoft – AI Skills Navigator – microsoft.com/en-us/ai/ai-skills
3. Andrew Ng – AI for Everyone (Coursera, free to audit) – coursera.org/learn/ai-for-everyone
4. Elements of AI – University of Helsinki (free, beginner) – elementsofai.com
5. AI Assistants: ChatGPT – chat.openai.com | Claude – claude.ai | Gemini – gemini.google.com | Microsoft Copilot – copilot.microsoft.com
6. Research & Notes: NotebookLM – notebooklm.google.com | Perplexity AI – perplexity.ai | Elicit – elicit.org | Consensus – consensus.app
7. Presentations & Docs: Gamma.app | Notion AI – notion.so | Beautiful.ai | Copilot in Office

365 | Gemini in Google Workspace

8. Diagrams & Design: Napkin.ai | Whimsical AI – whimsical.com | Miro AI – miro.com | Canva AI – canva.com | DALL-E 3 via ChatGPT
9. Data & Spreadsheets: ChatGPT Advanced Data Analysis | Julius AI – julius.ai | Copilot in Excel | Gemini in Sheets
10. Math & Equations: Wolfram Alpha – wolframalpha.com | Symbolab – symbolab.com | Mathway – mathway.com | Microsoft Math Solver – math.microsoft.com | Photomath – photomath.com | Desmos – desmos.com | GeoGebra – geogebra.org
11. Audio & Video: ElevenLabs – elevenlabs.io | Suno – suno.com | Runway – runwayml.com | HeyGen – heygen.com
12. Detection & Automation: GPTZero – gptzero.me | Originality.ai | Google Lens | Make.com | GitHub Copilot,

Online Learning Resources

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

PHYSICS FOR MECHANICAL SYSTEMS LAB

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

1. Course Objectives

- Determine optical properties of materials (dispersive power, refractive index, wavelength) using prisms, diffraction gratings, and interference techniques.
- Study wave phenomena in vibrating strings, tuning forks, and coupled oscillators.
- Investigate elastic and mechanical properties of materials using Hooke's law and torsional pendulum methods.
- Apply quantum concepts by estimating Planck's constant through the photoelectric effect.
- Employ laser-based and ultrasonic techniques to measure particle size and acoustic velocity in liquids

Course Pre/co requisites: Physics for Mechanical Systems (Theory)

2. Course Outcomes (COs)

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

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

CO2: Determine particle size using a diode laser and estimate Planck's constant from photoelectric-effect data, relating results to quantum and optical-measurement principles.

CO3: Determine the spring constant of a spring by Hooke's law and the rigidity modulus of the material of a wire by the dynamic (torsional-pendulum) method; analyse the elastic and mechanical behaviour of materials.

CO4: Verify the laws of stretched strings using a sonometer, determine tuning-fork frequency by Melde's experiment, study the normal modes of a coupled oscillator and loaded-spring oscillations, and determine ultrasonic velocity in a liquid using an acoustic grating; evaluate results against theoretical predictions.

CO5 Automate vibration/oscillation signal analysis and spring-constant extraction using Python regression, and apply scikitlearn/TensorFlow-based techniques for anomaly or defect detection in vibration/NDT data; evaluate computational-model accuracy.

3. Course Syllabus

PART-A

LIST OF EXPERIMENTS (Perform any 10 experiments)

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

8. Determination of spring constant by Hooke's law
9. Melde's experiment: Determination of the frequency of the tuning fork
10. Sonometer: Verification of the three laws of stretched strings
11. Determination of ultrasonic velocity in liquid (Acoustic grating)
12. Determination of Rigidity modulus of the material of a wire, dynamic method (Torsional pendulum)
13. Determination of damped oscillations using spring mass system.
14. Determination of Spring Constant –Series and Parallel combinations
15. Study of Coupled Oscillations and determine the normal mode frequencies of a system of two identical pendulums coupled by a spring.

Part B – AI Integration Lab Exercises

Any two of the following AI exercises must be completed using Python / Google Colab or appropriate AI/LLM tools.

1. Oscillation & Vibration Signal Automation (Python / Matplotlib): input time-vsdisplacement data from the sonometer, Melde's, or coupled-oscillator experiment; fit a sinusoidal / damped-sinusoidal model to the signal; extract frequency, amplitude, and damping coefficient; overlay the fitted curve on the experimental data points.

2. Spring-Constant & Elastic Property Analysis (Python / NumPy): input load vs. extension data from the Hooke's-law or loaded-springs experiment; apply linear regression to extract the spring constant; automate computation of percentage error and R^2 against the expected value.

3. Vibration Anomaly / Defect Detection (Python / scikit-learn or TensorFlow): use vibration or acoustic-grating signal data (or a sample vibration/NDT dataset) to train a simple anomalydetection model or CNN-based crack/defect classifier; evaluate classification accuracy and discuss relevance to condition monitoring of mechanical components.

AI Integration

AI integration adds two to three exercises after the regular experiments:

(i) Python automation of oscillation/vibration signal analysis, fitting sinusoidal or damped-sinusoidal models to extract frequency and damping using Matplotlib/NumPy;

(ii) regression-based extraction of the spring constant and elastic parameters from Hooke's-law/loaded-spring data;

(iii) an introductory scikitlearn/TensorFlow exercise applying anomaly-detection or CNN-based classification to vibration or acoustic-grating signals — reinforcing the connection between the physical experiment and datadriven condition monitoring, and giving Mechanical Engineering students hands-on practice applying programming and machine-learning skills to experimental mechanics and NDT.

Free / Open-Source AI Tools

- Python (NumPy, SciPy, OpenCV, Matplotlib) on Google Colab (free) — wave-optics automation and vibration/signal analysis

• TensorFlow / Keras (free, open-source) — crack- and defect-detection CNNs on Google Colab • scikit-

learn (free, open-source) — anomaly detection in vibration and NDT data • PhET Interactive Simulations (free) — wave optics, quantum mechanics, and oscillations: phet.colorado.edu • Virtual Labs — IIT (free): https://iitb.vlabs.co.in/discipline.html?discipline=Physical_Sciences — online simulation of optics and mechanical-vibration experiments

• HyperPhysics (free) — concept reference for optics, quantum theory, and oscillations: hyperphysics.phy-astr.gsu.edu

- PhET Simulations — phet.colorado.edu
- NPTEL — nptel.ac.in
- Virtual Labs (IIT Bombay) — iitb.vlabs.co.in/discipline.html?discipline=Physical_Sciences

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

COMPUTATIONAL THINKING AND PROBLEM SOLVING WITH PYTHON LAB

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

1. Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

CO1	Apply computational thinking concepts to design algorithms, flowcharts, and Python programs.
CO2	Develop programs using decision-making and looping constructs to solve logical problems
CO3	Analyse and manipulate data using strings, lists, tuples, and sets.
CO4	Design modular programs using functions, recursion, and dictionaries.
CO5	Implement file handling, exception handling, and object-oriented concepts in Python applications.

3. Course Syllabus

MODULE I: COMPUTATIONAL THINKING & PROGRAMMING BASICS

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

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

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

Experiments:

- **Experiment 1: Problem Solving using Computational Thinking —** Select three daily-life problems; apply decomposition and abstraction; write algorithms, draw flowcharts, and convert them into pseudocode.
- **Experiment 2: Flowchart Design and Algorithm Simulation —** Design flowcharts for largest of three numbers, student grade calculation, and electricity-bill generation; simulate execution and verify outputs.

- **Experiment 3: Python Programming Fundamentals —** Install the Python environment; write programs using variables, data types, input/output, and operators; solve simple interest, area, and unit-conversion problems.

MODULE II: DECISION MAKING & LOOPING

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

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

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

Experiments:

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

MODULE III: STRINGS & DATA STRUCTURES

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

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

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

Experiments:

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

MODULE IV: FUNCTIONS & PROBLEM SOLVING

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

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

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

Experiments:

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

MODULE V: FILE HANDLING, EXCEPTION HANDLING & OOP

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

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

Suggested Tools: Python, ChatGPT, Microsoft Copilot

Experiments:

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

4. Books and Materials

Textbook (s)

1. Pieter Spronck, Computational Thinking with Python.
2. Reema Thareja, Programming in Python, Oxford University Press.

Reference Book(s)

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist.
2. Eric Matthes, Python Crash Course.
3. John Zelle, Python Programming: An Introduction to Computer Science,

Online Learning Resources

AI Assistants: ChatGPT, Microsoft Copilot – code generation, explanation test-case generation.

Flowchart & Diagramming: Flowgorithm, Lucidchart AI, draw.io AI – algorithm and flowchart design.

Visualization: Algorithm Visualizer, Python Tutor – execution tracing and recursion visualization.

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

COMMUNICATIVE ENGLISH LAB

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

1. Course Description

Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

CO1 To speak English with proper pronunciation using phonetic standards while displaying smooth, natural vocal fluency.

CO2 To demonstrate strong listening comprehension in English and communicate appropriately across various social and professional settings

CO3 To present well-reasoned arguments confidently during group discussions, debates, and formal presentations.

CO4 To compose well-structured, error-free professional documents—including emails, reports, and resumes—tailored to specific audience needs.

CO5 To apply AI-driven tools to support language learning, assess personal progress, and continuously refine English skills.

3. Course Syllabus

Lab Syllabus – 12 TOPICS WITH AI INTEGRATION

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

3	**Spoken English & Fluency Building**	Impromptu speaking (1–2 min); picture description; story completion tasks	AI analyses speech for filler words, pace, and clarity; ChatGPT prompts for spontaneous speaking	Speeko, ChatGPT, Google Assistant
4	**Group Discussion Techniques**	Role-based GD on current topics; turn-taking practice; consensus building	AI evaluates argument structure and language; ChatGPT generates counter-arguments for practice	ChatGPT, Gemini, Mentimeter
5	**Public Speaking & Presentations**	Prepare and deliver 3-minute presentations; use of visual aids; Q&A handling	AI slide deck generation; real-time delivery feedback on pacing and confidence	Beautiful.ai, Gamma.app, Microsoft Copilot
6	**Interview Skills & Mock Interviews**	HR round simulation; STAR method answers; body language and eye contact	AI-powered mock interview with instant feedback on content, grammar, and tone	Yoodli, Interview Warmup by Google, ChatGPT
7	**Professional Email & Business Writing**	Draft formal emails, complaints, and requests; subject line formulation; netiquette	AI refines email drafts; tone & clarity check; compare student draft with AI-improved version	Grammarly, ChatGPT, Gemini
8	**Resume & Cover Letter Writing**	ATS-friendly resume design; action verbs usage; tailoring cover letters to job descriptions	AI resume scanner; keyword optimisation suggestions; ChatGPT cover letter generation and critique	Kickresume, Resume.io, Jobscan, ChatGPT
9	**Reading Comprehension & Critical Thinking**	Read articles/editorials; identify main idea, inference, and tone; speed reading drills	AI generates comprehension questions; text summarisation and comparative analysis	Quillbot, Speechify, NotebookLM
10	**Debate & Argumentation Skills**	Structured debate (for/against); Rebuttal techniques; logical fallacy identification	AI generates arguments on both sides; evaluate logical structure using ChatGPT	ChatGPT, Claude.ai, Kialo Edu

11	**Report Writing & Technical Communication**	Lab report, incident report, and project report formats; headings, data presentation	AI improves report coherence and passive/active voice usage; grammar and structure feedback	Grammarly Business, ChatGPT, Hemingway Editor
12	**Etiquette, Netiquette & Personal Branding**	Workplace conversation role play; LinkedIn profile creation; professional social media etiquette	AI reviews LinkedIn summaries; digital persona analysis; personal brand statement via ChatGPT	ChatGPT, Canva AI, LinkedIn AI features

4. Books and Materials

Textbook (s)

1. Raman, Meenakshi & Sharma, Sangeeta. Technical Communication: Principles and Practice (3rd Ed.). Oxford University Press, 2022.
2. Krishnaswamy, N. & Krishnaswamy, L. The Story of English in India. Foundation Books, Cambridge University Press, 2021.

Reference Book(s)

1. Swan, Michael. Practical English Usage (4th Ed.). Oxford University Press, 2016.
2. Murphy, Raymond. English Grammar in Use (5th Ed.). Cambridge University Press, 2019..
3. Rizvi, M. Ashraf. Effective Technical Communication (2nd Ed.). McGraw-Hill Education, 2018
4. Turton, N.D. & Heaton, J.B. Longman Dictionary of Common Errors. Pearson Longman, 2017
5. Lesikar, Raymond V. & Flatley, Marie E. Basic Business Communication (12th Ed.). McGraw-Hill, 2020
6. Rutherford, Andrea J. Basic Communication Skills for Technology (3rd Ed.). Pearson, 2019

Online Learning Resources

- BBC Learning English – https://www.bbc.co.uk/learningenglish (Grammar, pronunciation, and listening)
- British Council Learn English – https://learnenglish.britishcouncil.org
- TED Talks – https://www.ted.com/talks (Listening & speaking practice)
- Coursera English Communication Skills Specialisation – https://www.coursera.org
- edX English for Professional and Academic Purposes – https://www.edx.org
- Grammarly Blog – https://www.grammarly.com/blog (Writing tips)
- ELSA Speak (App) – https://elsaspeak.com (AI pronunciation coach

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

HEALTH AND WELLNESS, YOGA AND SPORTS

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

1. Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

CO1	Explain the fundamental concepts of health, wellness, fitness and the dimensions of holistic well-being.
CO2	Demonstrate correct yogic practices – asanas, pranayama and meditation – for physical and mental health.
CO3	Design a personal fitness plan integrating nutrition, exercise, stress management and lifestyle modification.
CO4	Understand rules, skills and safety norms for a chosen sport and participate actively with sportsmanship.
CO5	Evaluate personal health indicators and reflect on lifestyle choices using technology and evidence-based practices.

3. Course Syllabus

UNIT I: Health, Wellness and Preventive Healthcare

Core Content:

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

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

Core Content:

- Introduction to Yoga – history, philosophy, Patanjali's Ashtanga Yoga
- Surya Namaskar – 12-step sequence with correct breathing

- Asanas for flexibility: Tadasana, Trikonasana, Paschimottanasana, Sarvangasana
- Asanas for strength & balance: Virabhadrasana I & II, Vrikshasana, Naukasana
- Pranayama techniques: Anulom-Vilom, Bhastrika, Kapalbhati, Bhramari
- Meditation and mindfulness – Dharana, Dhyana, body-scan, guided relaxation
- Yoga Nidra for sleep and stress relief
- Yoga for specific conditions – stress, back pain, PCOD/PCOS, anxiety
- Shatkarmas (cleansing processes) – an overview; International Day of Yoga

UNIT III: Physical Fitness, Sports Skills and Sports Technology

Core Content:

- Physical fitness components – strength, endurance, flexibility, agility, speed, coordination
- Principles of training
- – overload, progression, specificity, reversibility, individuality
- Warm-up, cool-down and dynamic stretching routines
- Indoor sports: Badminton, Table Tennis, Chess, Carrom – rules and basic skills
- Outdoor sports: Cricket, Football, Volleyball, Kabaddi, Athletics – rules and skills
- Sports injuries – types, RICE method, prevention and return-to-play protocol.

4. Books and Materials

Textbook (s)

1. E Dr. S. K. Mangal & Shubhra Mangal, Helath and Physical Education, PHI Learning Pvt LTd, 2021.
2. William J Broad, The Science of Yoga, Simaon and Schuster, 2012

Reference Book(s)

1. Silva, Mira & Shyam Mehta, Yoga: The Iyengar Way, Dorling Kindersley, 2019
2. Jim Clover, Sports Medicin Essentials, Cengage Learning, 2020
3. Charles A Bucher, Foundation of Physical Education and Sport, McGrawHill Education 2018

Online Learning Resources

- Ministry of AYUSH – https://main.ayush.gov.in
- Yoga for Youth (International Day of Yoga) – https://yoga.ayush.gov.in
- National Health Portal – https://nhp.gov.in
- ICMR Dietary Guidelines – https://www.icmr.nic.in
- Sports Authority of India – https://www.sportsauthorityofindia.nic.in
- WHO Physical Activity Guidelines – https://www.who.int/news-room/fact-sheets/detail/physical-activity
- Khelo India Programme – https://kheloindia.gov.in
- NIMHANS (Mental Health Resources) – https://nimhans.ac.in

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

CYBERSECURITY AWARENESS FOR ENGINEERS

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

1. Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

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

3. Course Syllabus

UNIT–I: INTRODUCTION TO CYBERSPACE AND CYBERSECURITY

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

UNIT–II: CYBER THREATS, CYBERCRIME AND SOCIAL ENGINEERING

Cyber threats and vulnerabilities – Cybercrime and cyber offenders – Malware: Virus, Worm, Trojan, Spyware, Ransomware – Cyberattack lifecycle and common attack methods – Phishing, Spear Phishing, Smishing and Vishing – Social engineering attacks – Password attacks and credential theft – Identity theft and financial fraud – Insider threats – AI-enabled cyber threats and deepfakes – Case studies of major cyber incidents.

UNIT–III: PERSONAL CYBER SAFETY AND CYBER SECURITY TECHNOLOGIES

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

UNIT–IV: PRIVACY, CYBER ETHICS AND CYBER LAWS

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

UNIT–V: CYBER HYGIENE AND SECURE DIGITAL PRACTICES

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

4. Books and Materials

Textbook (s)

1. Ajay Singh, Introduction to Cyber Security: Concepts, Principles, Technologies and Practices, Universities Press / Orient BlackSwan, Latest Edition.
2. Nina Godbole and SunitBelapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India

Reference Book(s)

1. Charles J. Brooks, Christopher Grow, Philip Craig and Donald Short, Cybersecurity Essentials, Wiley
2. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson.
3. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, Cengage Learning.
4. Joseph MiggaKizza, Guide to Computer Network Security, Springer.
5. Eric Cole, Cybersecurity for Beginners, Wiley

Online Learning Resources

- National Cyber Security Awareness Portal (India)
- CERT-In (Indian Computer Emergency Response Team)
- National Cyber Crime Reporting Portal
- NIST Cybersecurity Framework Resources
- OWASP Foundation

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

II SEMESTER (I YEAR)										
Course Code	Title of the Course	Category	Periods perWeek				Credits	Scheme of Examination Maximum Marks		
			L	T	Pr	P	C	Internal	External	Total
26MAT201	Differential Equations & Vector Calculus	BS	3	0	2	0	4	30	70	100
26CHE203	Applied Chemistry for Mechanical Engineers	BS	3	0	0	0	3	30	70	100
26MEC101	Engineering Graphics	ES	1	0	4	0	3	30	70	100
26MEC201	Engineering Mechanics	PC	3	0	0	0	3	30	70	100
26HSM101	Design Thinking	HM	1	0	4	0	3	30	70	100
26MEC202	Basic Simulation Lab	PC	0	0	0	2	1	30	70	100
26CHE204	Applied Chemistry for Mechanical Engineers Lab	BS	0	0	0	3	1.5	30	70	100
26MEC102	Engineering Workshop	ES	0	0	0	3	1.5	30	70	100
26HSM102	NSS/NCC/Scouts & Guides/ Community Service	HM	0	0	0	1	0.5	-	100	100
		TOTAL	11	0	10	09	20.5	240	660	900

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

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

1. Course Objectives

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

Course Pre/corequisites

A50001 – Linear algebra and Calculus

2. Course Outcomes (COs)

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

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

3. Course Syllabus

UNIT I: First-Order Ordinary Differential Equations

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

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

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

UNIT II: Higher-Order Linear Differential Equations

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

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

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

UNIT III: Partial Differential Equations

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

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

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

UNIT IV: Vector Differentiation

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

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

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

UNIT V: Vector Integration and Integral Theorems

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

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

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

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

APPLIED CHEMISTRY FOR MECHANICAL ENGINEERING

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

1. Course Objectives

- Understand corrosion mechanisms and surface engineering in mechanical systems.
- Analyze fuels, combustion, and energy conversion processes.
- Study lubrication chemistry and material behavior under friction.
- Explore engineering materials including metals, polymers, and composites.
- Apply AI/ML tools for prediction, optimization, and sustainability in mechanical engineering.

2. Course Outcomes (COs)

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

CO1	Analyze corrosion and recommend protection methods.
CO2	Evaluate fuels and combustion processes.
CO3	Apply lubrication principles in mechanical systems.
CO4	Analyze engineering materials and composites.
CO5	Design sustainable solutions using green chemistry and AI tools

3. Course Syllabus

UNIT I: Corrosion chemistry and protective methods

UNIT Objectives:

- To understand corrosion mechanisms and prevention in mechanical components
- To comprehend electroplating and surface treatment processes for enhancing component properties

UNIT Outcomes:

- Students can analyze corrosion types in mechanical systems and recommend prevention strategies
- Students can design surface treatment processes for improving wear resistance and corrosion protection

Content:

- Chemical (Atmospheric corrosion: rusting of iron and steel) and Electrochemical theories of corrosion: anodic and cathodic reactions, electrochemical series.
- Types of corrosion: uniform, galvanic, pitting, crevice, intergranular, stress corrosion.
- Corrosion prevention: cathodic protection, protective coatings-Galvanizing: hot-dip galvanizing, electro galvanizing, Sherardizing.
- Electroplating: principles, process parameters (current density, temperature, pH) Ex: Copper plating, Nickel plating
- Anodizing: aluminium anodizing, hard anodizing, coloring
- Surface hardening: carburizing, nitriding, carbonitriding, flame hardening
- Conversion coatings: phosphating and chromating.

AI Integration: Machine learning models for corrosion prediction based on environmental and material data. Image-based corrosion detection using computer vision.

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

UNIT II: Energy Chemistry (Fuels and Combustion

UNIT Objectives:

- To understand the chemistry of fuels and combustion processes for mechanical systems
- To evaluate energy conversion and alternative fuels for automotive applications

UNIT Outcomes:

- Students can analyze fuel properties and combustion efficiency for engines and boilers
- Students can assess alternative fuels and their suitability for mechanical engineering applications

Content:

- Classification of fuels: solid, liquid, gaseous fuels, calorific value: HCV and LCV, Dulong's formula, problems. Calorific value determination: bomb calorimeter, problems.
- Solid fuels (Coal): classification (anthracite, bituminous, lignite, peat), analysis (proximate, ultimate), carbonization
- Liquid fuels (Petroleum oil): composition, refining processes (fractional distillation and cracking- thermal and catalytic), Synthetic fuels: Fischer-Tropsch synthesis
- Green fuels- Green hydrogen, Hythane.
- Knocking in IC engines (petrol engines): octane number, anti-knock additives: Tetra ethyl Lead (TEL), Methyl Tertiary Butyl Ether (MTBE), ethanol.
- Knocking in diesel engines: cetane number, ignition quality, anti-knock additives.
- Combustion -- problems.

AI Integration: AI models to optimize fuel efficiency and combustion performance. Data analysis of engine parameters using regression models.

Free/Open-Source AI Tools: Python (NumPy, Pandas), TensorFlow, Google Colab

UNIT III: Chemistry of Lubricants

UNIT Objectives:

- To understand the science of friction, wear, and lubrication in mechanical systems
- To evaluate lubricant properties and selection criteria for various applications

UNIT Outcomes:

- Students can explain friction and wear mechanisms and their impact on machine components
- Students can select appropriate lubricants based on chemical composition and operating conditions

Content:

- Friction and wear, seizure (soiling and rolling friction) functions of lubricants.
- Mechanisms of lubrication a. Fluid-film or thick-film or hydrodynamic lubrication, b. boundary film lubrication or thin-film lubrication, c. Extreme-pressure lubrication
- Lubricants: classification
- Solid lubricants: graphite, molybdenum disulfide (MoS2), Poly tetra fluoro ethylene (PTFE).
- Semi-solid lubricants: Greases-composition (base oil + thickener + additives), National Lubricating Grease Institute (NLGI) grades, applications
- Liquid lubricants: animal and vegetable oils, mineral or petroleum oils, blended oils.
- Properties of lubricants (Definition and significance)

AI Integration: Predictive maintenance using AI for lubricant degradation analysis. Data-driven selection of lubricants based on operating conditions.

Free/Open-Source AI Tools: Python, Excel AI tools, scikit-learn.

UNIT IV: Engineering Materials and Composites

UNIT Objectives:

- To understand the chemistry and properties of materials used in mechanical engineering
- To evaluate composite materials and their processing for mechanical applications

UNIT Outcomes:

- Students can explain structure-property relationships in metals, polymers, and ceramics
- Students can design and fabricate composite materials for specific mechanical applications

Content:

- 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 polymerizations, examples, thermoplastics, thermosets,
- Engineering polymers: Preparation and engineering applications of Nylon, polycarbonate, Acrylonitrile Butadiene styrene (ABS), Polyether ether ketone(PEEK), Polytetrafluoroethylene (PTFE)
- Polymer processing: Injection moulding, Extrusion moulding, Compression moulding
- Elastomers- Natural rubber, vulcanisation, synthetic rubbers (BUNA-S and BUNA-N)
- Ceramics: alumina, silicon carbide, silicon nitride, zirconia and applications
- Refractories: characteristics, classification and properties of refractories.
- Composite materials: classification and applications.

  AI Integration: AI-based material property prediction and selection. Machine learning for composite optimization and performance analysis.

  Free/Open-Source AI Tools: TensorFlow, Orange Data Mining, Python

UNIT V: Chemistry of Green Engineering

UNIT Objectives:

- To understand principles of green chemistry for sustainable engineering practices
- To evaluate environmental impacts of construction materials and processes

UNIT Outcomes:

- Students can apply green chemistry principles to select sustainable materials and processes.
- Students can assess environmental chemistry aspects relevant to engineering projects.

Content:

- Principles of green chemistry and their applications
- Sustainable construction materials: geopolymer concrete, recycled aggregates, industrial by-products (fly ash, Ground Granulated Blast-furnace Slag (GGBS)
- Air pollution: types, sources, effects; air quality index
- Water pollution: sources, effects and remedial methods.
- Chemistry of greenhouse gases and climate change
- Soil chemistry: pH, organic matter, contamination, remediation
- Solid waste management: classification, treatment, recycling in construction

AI Integration: AI-based environmental impact assessment and life-cycle analysis. Air quality prediction models.

Free/Open-Source AI Tools: OpenLCA, Python, Google Colab

4. Books and Materials

Textbook (s)

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

Reference Book (s)

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.

Online Learning Resources

- Society of Tribologists and Lubrication Engineers (STLE). (2023). Tribology and lubrication resources. https://www.stle.org/
- ASM International. (2023). Materials information and education. https://www.asminternational.org/
- Society of Automotive Engineers (SAE). (2023). Automotive engineering standards. https://www.sae.org/
- American Society of Mechanical Engineers (ASME). (2023). Mechanical engineering resources. https://www.asme.org/
- National Association of Corrosion Engineers (NACE). (2023). Corrosion prevention and control. https://www.nace.org/

Recommended Free & Open-Source Chemistry / AI Tools

- Language & Environment: Python, Google Colab – scripting and prototyping used across all five units.
- ML Libraries: scikit-learn, TensorFlow, NumPy, Pandas, Orange Data Mining – model building, regression, and data analysis.
- Computer Vision: OpenCV – image-based corrosion detection.
- Specialized Tools: OpenLCA – environmental life-cycle analysis; Excel AI tools – lubricant data analysis and selection.

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

ENGINEERING GRAPHICS

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

1. Course Objectives

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

Course Pre/corequisites

A50001 – Linear Algebra and Calculus

2. Course Outcomes (COs)

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

CO1	Construct engineering curves and scales using traditional drafting geometry validated by automated algorithmic paths.
CO2	Solve multi-planar projection instances of linear points, segments, and standard regular planar silhouettes.
CO3	Render projections of standard 3D solids and identify variations using structural boundary algorithms.
CO4	Draft complex cross-sectional geometries and mapped surface extensions of sliced geometric forms.
CO5	Produce composite isometric layouts alongside generative text-to-CAD system alternatives for dynamic prototyping.

3. Course Syllabus

UNIT I: Introduction to Engineering Graphics, Curves, and Scales Core

Content

Introduction: Principles of Engineering Graphics, signboards, BIS conventions, and lettering.
Curves: Construction of Polygons. Conic sections: Ellipse, Parabola, and Hyperbola using eccentricity/general methods. Cycloidal curves and Involutes.
Scales: Plain, Diagonal, and Vernier scales.
Hands-on Experience:
Manual draft generation of an ellipse and diagonal scale, paired with a software verification loop.
AI Integration Module: AI prompt engineering for generating geometric profiles; algorithmic generation of conic curves using mathematical code blocks; parsing hand-drawn geometric sketches into clean vector shapes using Computer Vision (CV) edge detection (Canny Edge/Hough Transform).

UNIT II: Orthographic Projections of Points, Lines

Core Content

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

Hands-On Experience & Application

Project: Construct a transformation script where a user inputting 2D projection endpoint automatically outputs the 3D line representation, true spatial length, and inclination angles without manual geometric tracking.
Application: Calibration setups for stereoscopic robotic arms tracking trajectories across multiple camera planes.
AI Integration Module: Machine learning pipelines for 3D coordinate estimation from 2D views; multi-view structural tracking; training neural models to predict true line length and orientation angles based solely on coordinate projections.

UNIT III: Projection of Regular Solids

Core Content:

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

Hands-On Experience & Application

- **Project**: Set up a classification notebook using scikit-learn or a simple convolutional model to automatically identify the type of solid (e.g., hexagonal prism vs. cone) present within an orthographic engineering layout image.
- **Application**: Automated automated component sorting inside factory staging bays and conveyor streams.

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

UNIT IV: Sections of Solids, Development of Surfaces, and AI Generative Design

Core Content:

Sections of Solids:Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only. **Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.
AI Integration Module: Generative Adversarial Networks (GANs) for generating flat-pattern configurations; algorithmic optimization of surface layouts to minimize sheet manufacturing scrap; predictive toolpath generation using physics-guided heuristic networks.

Hands-On Experience & Application

Project: Use a nesting optimization script (e.g., using genetic algorithms or standard heuristics) to arrange several custom flat-surface solid developments onto a finite raw sheet grid, actively minimizing material margins and cut lines.
Application: Sheet metal stamping pattern automation in automotive and aerospace chassis manufacturing.

UNIT V: Isometric Projections, Conversions, and 2D-to-3D Deep Reconstruction

Core Content:

Principles of isometric projection, isometric scale, isometric views/projections of planes, simple and compound solids. Conversion of isometric views to orthographic views and vice-versa.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (*Not for end examination*).

Hands-On Experience & Application

Project: Use a pretrained depth estimation or pixel-to-voxel neural model to parse a set of front, top, and side drawings, compiling them directly into an interactive 3D point cloud or boundary surface rendering.

Application: Instantly generating 3D printable mechanical files directly from archival 2D layout drafting logs.

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

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

ENGINEERING MECHANICS

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

1. Course Objectives

- Introduce fundamental concepts of mechanics, force systems, and equilibrium with applications in structural and mechanical engineering.
- Develop ability to draw and interpret free body diagrams for coplanar, concurrent, and spatial force systems.
- Calculate centroid, centre of gravity, and moment of inertia for simple and composite bodies.
- Understand the fundamental concepts of stress, strain, elasticity, and the mechanical behaviour of materials under different loading conditions.
- Introduce AI/ML tools for simulation, analysis, and visualization of mechanical systems

Course Pre/corequisites

Linear Algebra & Calculus

2. Course Outcomes (COs)

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

CO1 Remember and explain the fundamental concepts of mechanics including Newton's laws, types of forces, equilibrium conditions, and Coulomb's friction laws, and demonstrate their relevance to Civil and Mechanical Engineering applications.

CO2 Apply the principles of force systems, free body diagrams, and equilibrium equations to solve coplanar, concurrent, and spatial force problems including trusses, frames, and friction-based mechanisms using analytical and computational methods.

CO3 Analyze the geometric properties of engineering sections and bodies by calculating centroids, centre of gravity, and moments of inertia for composite shapes, and evaluate their significance in structural design using software tools.

CO4 Evaluate the motion and dynamic response of engineering systems using kinematics and kinetics of particles, applying work-energy and impulse-momentum principles and comparing analytical solutions with AI-based simulation outputs.

CO5 Recall and explain the fundamental concepts of stress, strain, Hooke's law, elastic constants, and their inter-relationships, and identify the mechanical behaviour of engineering materials under axial, thermal, and composite loading conditions.

3. Course Syllabus

UNIT I: Introduction, Force Systems & Friction

Core Content: Basic concepts of mechanics: scalar and vector quantities, Newton's laws, SI units. Coplanar concurrent forces: resultant by parallelogram law, triangle law, polygon law. Moment of a force: Varignon's theorem. Couples and resultants of force systems. Lami's theorem. Spatial force systems: vector representation, dot and cross products. Friction:

limiting friction, Coulomb's laws of dry friction, coefficient of friction, angle of friction, cone of static friction, impending motion problems, wedge friction, screw jack.

AI Integration: Introduction to AI in Engineering: concept of data, machine learning (ML), and simulation. Using Python (NumPy) to solve force equilibrium problems computationally. Introduction to MATLAB/Scilab for vector force calculations. Visualizing force systems using Matplotlib/Python.

Free/Open-Source AI Tools: Python (NumPy, Matplotlib) – Google Colab (free); Scilab (free MATLAB alternative); GeoGebra (free online vector visualization)

UNIT II: Equilibrium of Force Systems & Virtual Work

Core Content: Equilibrium conditions for coplanar systems: free body diagrams, equations of equilibrium ($\Sigma Fx=0$, $\Sigma Fy=0$, $\Sigma M=0$). Graphical methods: triangle and polygon of forces. Equilibrium of spatial systems. Analysis of plane trusses: method of joints, method of sections. Analysis of frames. Principle of virtual work: statement, applications to simple mechanisms and trusses.

AI Integration: Using Python/OpenSees (open source) for automated truss analysis. AI-based structural analysis: introduction to how FEM software uses matrix methods internally. Computer simulation of mechanism motion using Python. Visual debugging of FBDs using interactive tools.

Free/Open-Source AI Tools: OpenSees (free, open-source structural analysis); Python scipy.optimize for equilibrium solution; SAP2000 student edition (free); online truss solvers (free)

UNIT III: Centroid, Centre of Gravity & Moment of Inertia

Core Content: Centroid of lines, areas, and volumes from first principles. Centroid of standard shapes: rectangle, triangle, circle, semicircle, quarter circle. Centroid of composite figures using tabular method. Centre of gravity of 3D bodies: prismatic bodies, cones, hemispheres, composite bodies. Pappus theorems and their applications. Area moment of inertia: polar moment, transfer theorem (parallel axis theorem). MOI of composite sections. Product of inertia. Mass moment of inertia for simple and composite bodies.

AI Integration: Python scripting for automated centroid and MOI calculations of composite cross-sections. Using spreadsheets (LibreOffice Calc) and Python Pandas for tabular calculations. Introduction to how CAD software (AutoCAD/FreeCAD free) computes section properties. Application in AI-driven structural design optimization: cross-section selection.

Free/Open-Source AI Tools: Python (NumPy, Pandas) – Google Colab; FreeCAD (free, open-source CAD with section property computation); LibreOffice Calc (free)

UNIT IV: Kinematics & Kinetics of Particles

Core Content: Kinematics: rectilinear motion – displacement, velocity, acceleration relations; curvilinear motion – Cartesian and polar coordinates; projectile motion. Kinetics: Newton's second law; D'Alembert's principle; work-energy method: kinetic energy, work done, power, efficiency; impulse-momentum method: linear and angular; impact: direct and oblique central impact, coefficient of restitution.

AI Integration: AI in Autonomous Vehicles: how kinematic equations underpin self-driving car algorithms. Python simulation of projectile motion with drag (real-world). ML-based trajectory prediction: introduction to LSTM for motion prediction. Robot path planning using kinematic constraints. Using Python (matplotlib.animation) for interactive motion visualization.

Free/Open-Source AI Tools: Python (NumPy, Matplotlib, SciPy) – Google Colab; Tracker (free video analysis software for kinematics experiments); Algodoo (free 2D physics simulation)

UNIT V: Simple Stresses, Strains & Elastic Constants

Core Content: Elasticity and plasticity; types of stresses (tensile, compressive, shear) and strains (linear, lateral, shear, volumetric); Hooke's law; Poisson's ratio; elastic constants: E, G, K and their relationships; factor of safety; bars of varying cross-section; elongation under self-weight; bars in series and parallel; temperature stresses; stresses in composite bars.

Introduction to principal stresses and strains: principal planes, Mohr's circle for 2D stress state.
Strain Energy Resilience–Gradual, sudden, impact and shock loadings–simple applications.
AI Integration: ML for material property prediction: using regression models to predict Young's modulus and Poisson's ratio from material composition data. Python-based stress-strain curve fitting using SciPy. Introduction to data-driven material models in structural analysis. Overview of physics-informed neural networks (PINNs) for material mechanics (conceptual).
Free/Open-Source AI Tools: Python (NumPy, SciPy, Matplotlib) on Google Colab; Scilab (free); MIT OpenCourseWare stress analysis tools.

4. Books and Materials

Textbook (s)

1. Timoshenko S., Young D.H., Rao J.V. and Pati S., Engineering Mechanics, McGraw Hill Education, 5th Edition, 2017.
2. Bhavikatti S.S., A Textbook of Engineering Mechanics, New Age International Publications, 4th Edition, 2018.
3. Timoshenko S. and Gere J., Mechanics of Materials, CBS Publishers, 2006.
4. Strengthofmaterials,R.K.Rajput,S.Chand&Co,NewDelhi
5. Strength of Materials, Basavarajaiah B.S. and Mahadevappa P., Universities Press, 3rd Edition, 2010

Reference Book(s)

1. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, Pearson Education, 14th Edition, 2022.
2. Meriam J.L. and Kraige L.G., Engineering Mechanics (Statics & Dynamics), John Wiley, 6th Edition, 2008.
3. Shames I.H., Engineering Mechanics: Statics and Dynamics, PHI, 4th Edition, 2002.
4. Beer F.P. and Johnston E.R., Vector Mechanics for Engineers (Statics & Dynamics), McGraw Hill, 12th Edition, 2019.
5. Bhattacharya B., Introduction to Statics and Dynamics, Oxford University Press, 2nd Edition, 2014.
6. Goldberg D.E., Schaum's Outline of Fluid Mechanics and Hydraulics, McGraw Hill, 4th Edition, 2014

Online Learning Resources

- NPTEL: Engineering Mechanics – https://nptel.ac.in/courses/112105171
- NPTEL: Rigid Body Dynamics – https://nptel.ac.in/courses/112104120
- PhET Simulations (University of Colorado, Free): https://phet.colorado.edu/en/simulations
- MIT OpenCourseWare – Classical Mechanics: https://ocw.mit.edu/courses/8-01sc-classical-mechanics
- Google Colab for Python: https://colab.research.google.com
- OpenSees documentation: https://opensees.berkeley.edu
- Tracker Video Analysis (Free): https://physlets.org/tracker

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

DESIGN THINKING

Hours Per Week				Hours Per Semester				Credits	Assessment Marks		
L	T	Pr	P	L	T	Pr	P	C	CIE	SEE	Total
1	0	4	0	12	0	42	0	3	30	70	100

1. Course Objective

Design Thinking is a human-centred innovation methodology that equips students with a structured approach to understanding users, reframing complex problems, and developing creative solutions. This course integrates Artificial Intelligence tools at each stage of the design cycle—empathise, define, ideate, prototype, and test—enabling students to harness AI not merely as a tool but as a creative collaborator. Students work on real-world projects and submit iterative prototypes

Course Pre/corequisites

There are no pre/corequisites

2. Course Outcomes (COs)

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

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

3. Course Syllabus

UNIT 1: Introduction to Design Thinking

Core Concepts:

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

AI Integration:

- AI Tool: ChatGPT / Copilot – use AI to explain design thinking in different domains (healthcare, education, agriculture)
- Activity: Use MindMeister (free, open-source alternative: FreeMind) to create a mindmap of the 5-stage process
- AI Video Analysis: Watch an IDEO documentary and use AI to summarise key DT principles observed

UNIT 2: Empathise and Define Stages

Core Concepts:

- Empathy Methods: Interviews, Observation, Immersion, Shadowing
- Creating User Personas: Demographic, psychographic, goals and pain points

- Empathy Mapping: Says, Thinks, Does, Feels
- Point of View (POV) Statement: User + Need + Insight formula
- How Might We (HMW) Questions: Reframing problems as opportunities

AI Integration:

- AI Tool: Miro (free plan) – create digital empathy maps and POV statements collaboratively
- AI Tool: ChatGPT – generate diverse user persona profiles for a given problem context
- Activity: Interview 5 peers about a campus problem; use AI to analyse interview transcripts and extract themes
- AI Tool: Dovetail (free plan) – affinity mapping of qualitative research data

UNIT 3: Ideation Stage

Core Concepts:

- Creative Thinking Techniques: Brainstorming, Brainwriting, SCAMPER, Random Word Association
- Lateral Thinking: Edward de Bono's Six Thinking Hats
- Affinity Diagramming: Grouping ideas by themes
- Prioritisation Matrix: Impact vs. Effort, Dot Voting
- Concept Selection: Morphological charts and Pugh Matrix

AI Integration:

- AI Tool: ChatGPT – use 'expand my idea' prompts to generate 20 variations of a concept
- AI Tool: IdeaFlip (free) / Miro – digital brainstorming and affinity diagramming
- AI Tool: Midjourney (free trial) / DALL-E (free credits) – generate visual concept sketches from text descriptions
- Activity: Run a 30-minute AI-augmented brainstorming session and compare idea quality with pure human brainstorming

UNIT 4: Prototyping

Core Concepts:

- Principles of Prototyping: Low-fidelity vs. High-fidelity prototypes
- Paper Prototyping: Sketching UI and physical models
- Digital Wireframing: Introduction to wireframes and mockups
- 3D Prototyping Concepts: Introduction to 3D printing and rapid prototyping
- Role Plays and Experience Prototyping: Service design scenarios

AI Integration:

- AI Tool: Figma (free plan) – create digital wireframes and interactive mockups
- AI Tool: Uizard (free plan, AI-powered) – convert hand-drawn sketches to digital wireframes using AI
- AI Tool: Tinkercad (free, web-based) – create simple 3D models for physical prototyping
- Activity: Build a paper prototype for a chosen problem and photograph for digital documentation

UNIT 5: Testing, Iteration and AI in Design

Core Concepts:

- User Testing Methods: Think-aloud protocol, A/B testing, Usability testing
- Feedback Analysis: Affinity mapping of test feedback
- Iteration Cycle: Incorporating feedback and pivoting
- Design Presentation: Pitching to stakeholders (elevator pitch, demo day format)
- AI in Design: Overview of AI-assisted design (generative design, co-creation with AI)

AI Integration:

- AI Tool: Maze (free plan) – conduct remote usability tests on Figma prototypes
- AI Tool: ChatGPT – analyse collected user feedback and generate insights and improvement suggestions
- Activity: Present a final prototype to a panel; use AI to prepare pitch slides in Canva

Reflection: Create a Design Thinking journal documenting each stage with AI tool usage notes.

4. Books and Materials

Textbook (s)

1. Brown, Tim. (2019). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business, New York.
2. Lewrick, Michael, Link, Patrick & Leifer, Larry. (2018). The Design Thinking Playbook. Wiley, New Jersey

Reference Book(s)

1. IDEO.org. (2015). The Field Guide to Human-Centered Design. IDEO.org, San Francisco.
2. Kelley, Tom & Kelley, David. (2013). Creative Confidence: Unleashing the Creative Potential Within Us All. Crown Business.
3. Liedtka, Jeanne & Ogilvie, Tim. (2011). Designing for Growth: A Design Thinking Tool Kit for Managers. Columbia Business School Press.
4. Plattner, Hasso, Meinel, Christoph & Leifer, Larry (Eds.). (2018). Design Thinking Research. Springer.
5. Kumar, Vijay. (2012). 101 Design Methods: A Structured Approach for Driving Innovation. Wiley.
6. Stickdorn, Marc & Schneider, Jakob. (2021). This Is Service Design Thinking (Expanded ed.). BIS Publishers

Online Learning Resources

- Stanford d.school Resources: dschool.stanford.edu/resources
- IDEO Design Kit: www.designkit.org/methods
- MIT OpenCourseWare – Design Thinking: ocw.mit.edu
- Interaction Design Foundation: www.interaction-design.org
- NPTEL Design Thinking: swayam.gov.in

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

BASIC SIMULATION LAB

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

1. Course Objectives

- Master core programming concepts using MATLAB and Simulink tailored for mechanical systems.
- Visualize basic mathematical formulas and physical laws through simple coding steps.
- Develop basic graphical models to understand mechanical movements.
- Gain knowledge about MATLAB Simulink & solve engineering problems.
- Integrate Artificial Intelligence and Machine Learning to optimize mechanical engineering designs.

2. Course Outcomes (COs)

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

CO1 Develop custom computational scripts to automate data processing and data analysis.
CO2 Plot clear 2D and 3D graphs to analyze and present experimental engineering data..
CO3 Solve basic algebraic and simple differential equations using guided software tools.
CO4 Understand how modern AI assistants can be used ethically to troubleshoot code..
CO5 Apply machine learning toolboxes to predict structural failures and design smart control loops.

3. Course Syllabus

Exp 1: Introduction to MATLAB Programming

Core Syllabus: Introduction to the MATLAB interface (Command Window, Workspace), basic calculator functions, variables, creating simple vectors/arrays, basic arithmetic operations, and simple 2D line plotting.

Hands-on Experience: Write a simple script to calculate the area and volume of various mechanical components (cylinders, spheres) and plot a basic sine wave.

AI Applications: Code explanation, fixing basic syntax typos, and generating simple code templates.

AI Integration: Use MATLAB AI Chat Playground to ask: "Explain what this basic error message means and how to fix it."

Video Resources: MATLAB Onramp (MathWorks – Free 2-Hour Beginner Course).

Exp 2: Curve Fitting – Straight Line Fit

Core Syllabus: Concept of a line of best fit (y = mx + c), basic data importing from Excel, and introduction to the interactive Curve Fitting App.

Hands-on Experience: Import data from a standard Hooke's Law experiment (Force vs. Extension) and find the stiffness (k) of a spring using the visual app interface.

AI Applications: Spotting outliers or bad data points in an experimental dataset.

AI Integration: Use the interactive Curve Fitting App to automatically generate the linear code without writing it from scratch.

Video Resources: How to Use the Curve Fitting App (MathWorks YouTube).

Exp 3: Curve Fitting – Polynomial Fit

Core Syllabus: Moving beyond straight lines, understanding non-linear trends, basic concept of a quadratic equation curve, and evaluating fit quality visually.

Hands-on Experience: Fit a smooth curve to a car's displacement-time data to visually observe acceleration trends.

AI Applications: Simple pattern matching and trend prediction based on historical data.

AI Integration: Use the Regression Learner App to explore how a machine learning model can "train" on points to guess a curve.

Video Resources: Basic Curve Fitting Techniques (MathWorks).

Exp 4: Numerical Integration and Differentiation – Trapezoidal Method

Core Syllabus: Understanding integration as the simple "area under a curve", dividing an area into basic strips, using the built-in trapz command.

Hands-on Experience: Estimate the total work done by a constant or changing force acting over a distance by calculating the area under a Force-Displacement graph.

AI Applications: Approximating geometry dimensions from digital sensor data streams.

AI Integration: Use generative AI tools to write the logic for a basic for-loop that adds up the areas of separate shapes.

Video Resources: Concept of Integration and Trapezoidal Rule (Khan Academy).

Exp 5: Numerical Integration and Differentiation – Simpson Method

Core Syllabus: Introduction to Simpson's rule as a smarter way to find areas using curved tops instead of flat trapezoids, comparing accuracy.

Hands-on Experience: Find the cross-sectional area of an irregular mechanical bracket or a river bed profile using standard measurement intervals.

AI Applications: Smart shape recognition and automated area estimation in basic design software.

AI Integration: Compare results from the Trapezoidal script and Simpson script using an AI assistant to analyze which method is more accurate.

Video Resources: Simpson's Rule Made Easy (NPTEL / Online Tutorials).

Exp 6: Linear and Nonlinear Equations

Core Syllabus: Solving a system of basic linear equations (like finding two unknown forces), finding roots of an equation graphically, using simple commands like roots or fzero.

Hands-on Experience: Find the precise point where a projectile hits the ground by calculating the zero-crossing root of its trajectory equation.

AI Applications: Finding optimal balance points in manufacturing systems or structural designs.

AI Integration: Use the interactive Optimization Tool wizard to find the minimum weight of a box without manually calculating derivatives.

Video Resources: Solving Equations in MATLAB (MathWorks Tutorial).

Exp 7: Ordinary Differential Equations & Transforms

Core Syllabus: Introduction to differential equations as "rates of change" (e.g., speed changing over time), step-by-step calculation using basic Euler logic, using the ode45 app wizard.

Hands-on Experience: Simulate a hot cup of coffee cooling down over time according to Newton's Law of Cooling.

AI Applications: Simple time-series trend forecasting (e.g., predicting when a component will overheat).

AI Integration: Use the Live Editor Task for Solving ODEs to define and solve the cooling rate visually without deep programming.

Video Resources: Introduction to ODEs in MATLAB (MathWorks).

Exp 8: Engineering Applications Analysis (Basic Mechanics Focus)

Core Syllabus: Simulating fundamental concepts from First-Year Engineering Mechanics: static equilibrium, basic lever arms, and simple velocity profiles.

Hands-on Experience: Plot how the velocity of a falling object changes over time when affected by gravity and simple air resistance.

AI Applications: Identifying unexpected changes or failures in basic mechanical setups.

AI Integration: Use the System Identification App to upload data from a basic pendulum swing and let the tool guess its length and drag.

Video Resources: Engineering Mechanics Animations using MATLAB (Online Lectures).

Exp 9: MATLAB Simulink – Introduction to Graphical Modeling

Core Syllabus: Introduction to the drag-and-drop Simulink interface, working with basic blocks (Sources, Sinks, Gains, Integrators), and connecting signals visually.

Hands-on Experience: Build a visual block diagram model of a basic water tank filling up over time, without writing any lines of code.

AI Applications: An introduction to modern digital twins and graphical system simulations.

AI Integration: Use Simulink Onramp interactive widgets to discover how pre-trained machine learning blocks can predict the output of a system.

Video Resources: Simulink Onramp (MathWorks – Free 2-Hour Visual Guide).

4. Books and Materials

Textbook (s)

- Holly Moore, MATLAB for Engineers (6th Edition) — designed for first-year engineering students; covers environment setup, script writing, matrix tracking, arrays, and basic plotting.
- Agam Kumar Tyagi, MATLAB and SIMULINK for Engineers — explains coding logic alongside graphical block layout building.
- Dr. Shailendra Jain, Modeling and Simulation using MATLAB – Simulink — guides beginners through visual modeling, scopes, and signal connections.

Reference Book (s)

- Steven C. Chapra & Raymond P. Canale, Numerical Methods for Engineers, McGraw Hill Education India.
- John H. Mathews & Kurtis D. Fink, Numerical Methods Using MATLAB.
- Won Y. Yang, Wenwu Cao, Tae-Sang Chung & John Morris, Applied Numerical Methods Using MATLAB

Recommended Free & Open-Source AI/Computational Tools

- Language & Environment: MATLAB, Simulink – scripting, curve fitting, numerical methods, and graphical modelling.
- AI Assistants: MATLAB AI Chat Playground – code explanation and debugging support.
- Interactive Apps: Curve Fitting App, Regression Learner App, Optimization Tool, System Identification App, Live Editor Task for ODEs – guided, low-code problem solving.
- Video Resources: MATLAB Onramp, Simulink Onramp, NPTEL, Khan Academy – free guided video tutorials.

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

APPLIED CHEMISTRY FOR MECHANICAL ENGINEERS LAB

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

1. Course Objectives

- Perform redox, acid-base, and instrumental titrations to determine the concentration and strength of chemical species.
- Analyze coal samples through proximate analysis to determine moisture content.
- Verify adsorption isotherms and apply them to understand solid-liquid interface phenomena.
- Study the corrosion behavior of metals under different environmental conditions.
- Apply instrumental methods (conductometry, potentiometry, pH-metry, spectrophotometry, viscometry) for quantitative chemical analysis relevant to mechanical engineering.

2. Course Outcomes (COs)

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

CO1 Estimate the concentration of ferrous iron and acid strength using redox and acid-base titration.

CO2 Determine moisture content in coal samples and verify the Freundlich adsorption isotherm.

CO3 Analyze crystal structures, diffraction patterns and material properties using X-ray diffraction methods and basic AI-assisted material characterization tools.

CO4 Perform conductometric, potentiometric, and pH-metric titrations using instrumental methods..

CO5 Determine wavelength using spectrophotometry and viscosity of lubricating oils using a Red-Wood Viscometer

3. Course Syllabus

General Chemistry Experiments

- 1.Estimation of Ferrous Iron (Fe+2) using potassium dichromate (K2Cr2O7) (Redox titrations)
- 2.Determination of strength of acid (HCl) using Sodium Hydroxide
- 3.Determination of moisture content in coal sample (Proximate analysis)
- 4.Verification of Freundlich Adsorption isotherm (Adsorption of acetic acid by charcoal)
- 5. Determination of corrosion.
- 6. Determination of corrosion by environment.

Instrumental methods of chemical analysis

- 7. Conductometric titrations of strong acid Vs strong base (Ex: HCl Vs NaOH)
- 8. Potentiometry (Redox titrations)-Estimation of Iron (Fe+2) using potassium dichromate (K2Cr2O7)
- 9. pH metry - Estimation of Hydrochloric acid (HCl) using Sodium Hydroxide (NaOH)
- 10. Spectrophotometry - Determination of wavelength (λ) and verification of Beer's – Lamberts law.
- 11. Determination of viscosity of lubricating oil using Red-Wood Viscometer - I

- 12. Determination of viscosity of lubricating oil using Red-Wood Viscometer - II

AI Extension: Data acquisition and analysis using Python/Excel. Predictive analysis for corrosion and lubrication behavior.

Online Learning Resources

- STLE
- ASM International
- SAE
- ASME
- NACE

Recommended AI Tools

Python: NumPy, Pandas, Matplotlib
ML Frameworks: TensorFlow / Scikit-learn
Computer Vision: OpenCV
Data Mining: Orange Data Mining
Life-Cycle Analysis: OpenLCA

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

ENGINEERING WORKSHOP

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

1. Course Objectives

- Create awareness of safety precautions required at workplace
- Master fundamental hand tools and traditional manufacturing craftsmanship.
- Practice on manufacturing components using workshop trades including fitting, Sheet metal and carpentry, foundry and welding.
- Import basic electrical engineering knowledge for House Wiring Practice
- Demonstrate fundamentals of foundry and welding.

2. Course Outcomes (COs)

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

CO1	Recognize the importance of safety precautions while working in the workshop.
CO2	Identify different measuring, marking, cutting tools used in the workshop and their operational capabilities.
CO3	Fabricate precision wood and metal fitting joints within standard specifications.
CO4	Understand Wire standard, safe residential switches, lighting circuits, and basic appliances.
CO5	Identify different tools used in foundry and welding sections.

3. Course Syllabus

1. Safety Practices & Precautions
Demonstrate the necessity of Workshop hazards, various Personal Protective Equipment and emergency protocols.
AI Integration: Computer vision for safety compliance.
2. Wood working: Introduction to different types of woods, carpentry tools, timber joints
a) Half – Lap joint b) Mortise and Ten on joint c) Corner Dovetail joint or Bridle joint
3. Fitting: Familiarity with different types of tools used in fitting and perform fitting exercises like a) V-fit b) Dovetail fit c) Semi-circular fit
4. Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
5. Electrical wiring: Introduction to electrical tools, safety precautions, wiring materials.
Familiarity with different types of basic electrical circuits and make the following connections.
a) Parallel and series b) Two-way switch c) God own lighting d) Tube light e) Three phase motor f) Soldering of wires
6. Plumbing: Introduction to plumbing tools, pipe fittings, thread cutting, making a simple PVC pipe joint. Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of a simple Lap joint/Butt joint.
8. Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for a simple Patterns.

9. Introduction to 3D Printing: Demonstrate the core concepts of 3D printing, Hardware, software, Digital file and 3D printing materials. Familiarise with 3D Printing Process of complex objects.

10. Computer Components:

Disassemble and reassemble a desktop computer to understand the role of each component (CPU, motherboard, RAM, HDD/SSD, GPU, etc.).

Hardware Troubleshooting & Peripheral Installation:

Simulate common hardware issues (e.g., RAM failure, CPU overheating) and identify the procedures to resolving them.

Peripheral Installation:

Install and configure peripheral devices such as printers, scanners, and external hard drives.

Network Setup and Configuration:

Set up a small LAN network with routers, switches, and computers. Configure IP addresses, subnet masks, and basic network services.

11. **Disassembly and Assembly of equipment such as Bicycle, Gear Box, Braking System:**

Familiarise with disassembly and assembly process

AI Integration Module: Smart energy monitoring using IoT current sensors; building machine learning load forecasting models; training anomaly detection systems to automatically flag electrical arc or leakage patterns.

Develop predictive load-monitoring models that detect faulty configurations or phantom energy drains.

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

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

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, KURNOOL (AUTONOMOUS)

NSS / NCC / Scouts & Guides / Community Service

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

1. Course Description

Course Objectives

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

Course Pre/corequisites

There are no Pre/corequisites

2. Course Outcomes (COs)

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

CO1	Understand the philosophy, history, and objectives of NSS/NCC/Scouts & Guides and community service programmes.
CO2	Demonstrate leadership, teamwork, and organisational skills through camp/parade/drill activities.
CO3	Plan and execute community service projects addressing social issues like health, hygiene, literacy, and environment.
CO4	Apply first aid, disaster-preparedness, and civic responsibilities in real-world scenarios.
CO5	Develop civic sense, national integration, and sustainable community-development values.

3. Course Syllabus

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

Core Content:

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

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

Core Content:

- Leadership development – theories and models (situational, transformational)
- Team building, communication & conflict resolution
- Parade, drill & physical training basics
- Map reading, navigation and field craft (NCC)
- Camp organisation – planning, logistics, safety protocols

- Adventure activities: trekking, rock-climbing, swimming (awareness)
- Disaster management – concepts, types, roles of NSS/NCC volunteers
- First Aid – CPR, wound management, fractures, snake bite, burn

UNIT III: Community Projects, Social Awareness and Service Documentation

Core Content:

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

4. Books and Materials

Textbook (s)

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

Reference Book(s)

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

Online Learning Resources

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