Academic Regulations

Course Structure & Detailed Syllabus

CHOICE BASED CREDIT SYSTEM

R25

MECHANICAL ENGINEERING

Bachelor of Technology (B.Tech)

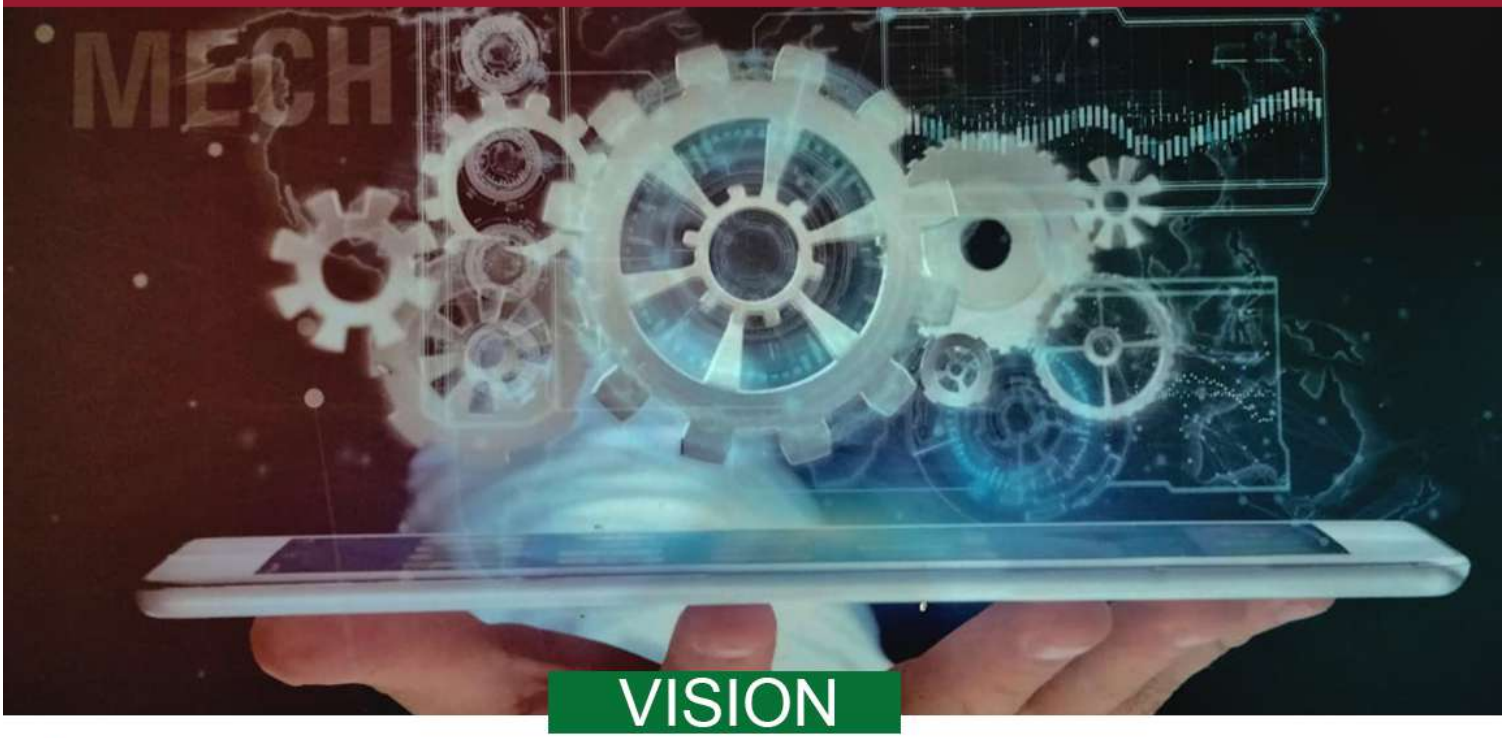
For the batches admitted from the A.Y. 2025-26

MARRI LAXMAN REDDY
GROUP OF INSTITUTIONS

MLR Institute of Technology

(Autonomous)
Laxman Reddy Avenue, Dundigal
Hyderabad – 500043, Telangana State
www.mlrit.ac.in, Email: director@mlrinstitutions.ac.in

MECHANICAL ENGINEERING



VISION

- The Mechanical Engineering Department endeavors to be recognized globally for outstanding education and research leading to well qualified engineers, who are innovative, entrepreneurial and successful in advanced fields of mechanical engineering to cater the ever changing industrial demands and social needs.

MISSION

- Impart highest quality education to the students to build their capacity and enhancing their skills to make them globally competitive mechanical engineers and successful entrepreneurs.
- Provide the students with academic environment of excellence, state of the art research facilities, leadership, ethical guidelines and lifelong learning needed for a long productive career.

Program Educational Objectives (PEOs)

PEO1: To prepare the students to excel in undergraduate and post graduate in Mechanical engineering to mould their careers for successful employment in industry, academic and entrepreneurial activities.

PEO2: Graduates of the Mechanical engineering program will analyze and synthesize data and apply technical concepts which lead to the design of new products, improve upon existing products and systems and develop technical problem-solving skills

PEO3: Graduates will excel in a wide range of Mechanical engineering fields such as Design, Analysis, multi-disciplinary areas.

PEO4: Graduates will have excellent oral and written communication skills, cooperative learning skills, ethical attitude and an ability to relate engineering issues to broader social environment.

PEO5: To provide a passionate academic environment for students that encourage learning of emerging technologies, acquire leadership qualities and guidelines needed for a successful career and engage in lifelong learning.

Course Structure & Detailed Syllabus

CHOICE BASED CREDIT SYSTEM

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MECHANICAL ENGINEERING

Bachelor of Technology (B.Tech.)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2025 - 2026)
&
B. Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2026 - 2027)

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ACADEMIC REGULATIONS

R25

Bachelor of Technology (B.Tech)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2025-2026)
&
(For batches admitted Lateral Entry Scheme from the academic year 2026-2027)

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ACADEMIC REGULATIONS (R25)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2025-26)

1.0 For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by MLR Institute of Technology under Autonomous status is herein referred to as MLRIT (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2025-26 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for MLR Institute of Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, MLR Institute of Technology shall be the chairman Academic Council.

2.0 Eligibility for Admission

2.1 Admissions to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified students at the entrance test conducted by Telangana Government (EAPCET) or the college or on the basis of any other order of merit approved by the college, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instruction for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0 B.Tech. Programme Structure

3.1 A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years and a maximum period of **eight** academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. course. Each student has to secure a minimum of 160 credits out of 164 credits for successful completion of the undergraduate programme and award of the B.Tech. degree.

3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms.

3.2.1 Semester Scheme

The undergraduate programme is of four academic years and there shall be two semesters in each academic year. There shall be a minimum of 15 weeks of instruction, excluding the mid-term and semester-end exams. Around 15 instruction hours, 30 instruction hours and 45 hours of learning need to be followed per one credit of theory course, practical course and project/field-based learning respectively. In each semester, there shall be 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS). The curriculum/course structure suggested by AICTE is followed as a reference document.

3.2.2 Credit Courses

All courses offered in each semester are to be registered by the student. Against each course in the course structure, the L: T: P: C (lecture periods: tutorial periods: practical periods: credits) pattern has been defined.

- One credit is allocated for one hour per week in a semester for lecture (L) or Tutorial (T) session.
- One credit is allocated for two hours per week in a semester for Laboratory/ Practical (P) session.
- One credit is allocated for three hours per week in a semester for Project/Mini-Project session.

For example, a theory course with three credit weightage requires three hours of classroom instruction per week, totaling approximately 45 hours of instruction over the entire semester.

3.2.3 Subject Course Classification

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry courses
2		ES - Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social Sciences	Includes courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent branch of Engineering.
7	Project Core	Project Work	B.Tech. Project Work
7	Other Core Courses (OCC)	Industry Training/ Internship/ Industry Oriented Mini-project/Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/Skill Development Courses
8			
9		Seminar	Seminar based on core contents related to parent branch of Engineering.
10	Skill Development Courses (SDC)	-	Courses designed to help individuals gain, improve, or refine specific skills
11	Value Added Courses (VAC)	-	Courses to build professional values, traditional knowledge and sensitization of societal issues

4.0 Mandatory Induction Programme

An induction program of one week duration for the UG students entering the institution, right at the start shall be implemented. Normal classes commence only after the induction programme is conducted. Following activities could be part of the induction programme: i) Physical Activity, ii) Creative Arts, iii) Imparting Universal Human Values, iv) Literary Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

5.0 Course Registration

5.1 A faculty advisor / mentor shall be assigned to a group of around 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choices/options of the courses, based on their competence, progress, pre-requisites and interest.

5.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The online registration requests for semester courses shall be completed two weeks before the commencement of SEEs (Semester End Examinations) of the preceding semester.

5.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/mentor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, faculty advisor/ mentor and the student.

5.4 A student shall register for all the courses offered in a semester as specified in the course structure.

5.5 Course options exercised through **on-line** registration are final and **cannot** be changed; further, alternative choices also will not be considered. However, if the course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternative choice either for a new course (subject to offering of such a course), or for another existing course. Such alternative arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week**, but before the commencement of class-work of the semester.

5.6 The Head of the Department / Course Coordinator should review vacant slots in the timetable of each section once in every week or fortnight. The vacant slots in the time-table may be allocated to the subject teachers who could not take classes in proportion to the number of weeks completed from the commencement of the semester.

5.7 Two faculty members may be allocated for the tutorial session of Mathematics-1 course for better interaction/practice and to minimise the failures in the subject.

5.8 **Professional Electives**: The students have to choose six Professional Electives (PE-I to PE-VI) from the six baskets of professional electives given.

Students have the flexibility to choose from the list of professional electives offered by the Institute or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed from time to time by the college.

5.9 **Open Electives**: Students have to choose three Open Electives (OE-I, II & III) from three baskets of Open Electives given by other than the parent department. However, the student can opt for an Open Elective course offered by his parent department, if the student has not studied that course so far. Similarly, Open Elective courses being studied should not match with any courses of the forthcoming semesters.

5.10 Provision for Early Registration of MOOCs:

For a professional elective in a semester, students are allowed to register for an equivalent MOOCs course listed from time to time by the college one semester in advance. For example, a Professional Elective of III Year II Sem shall be allowed to register under MOOCs platform in III year I Sem.

The credits earned in one semester in advance can be submitted in the subsequent semester for the assessment.

The students who have registered in advance in an equivalent MOOCs course and fail to secure any pass grade in the MOOCs course, can register for the regular course offered in the following semester of their course structure.

5.11 **Conversion of Marks Secured in MOOCs into Grades**: Marks secured in the internal and external evaluations of a MOOCs course shall be scaled to 40 and 60 marks respectively. The sum of these two components shall be considered as the total marks out of 100. The corresponding grade shall then be determined as per the marks-to-grades conversion rules specified in Clause 10.3.

5.12 MOOCs are allowed only for professional elective courses and for a few Minors & Honors courses

5.13 **Additional learning resources:**

Students are encouraged to acquire additional course-related knowledge by auditing learning resources from MOOCs platforms for each course offered in their course structure. These additional courses are not meant for earning credits but are intended to enhance knowledge. The college shall notify such courses from time to time through their portals for the benefit of students. They are categorized into three types: prerequisite, reinforcement, and aspirational. Prerequisite courses help students gain familiarity and provide sufficient background. Reinforcement courses aim to offer different perspectives on learning, while aspirational courses focus on next-level or advanced learning.

6.0 **Rules to offer Elective courses**

6.1 An elective course may be offered to the students, only if a minimum of 25% of class strength opts for it.

6.2 Same elective course for different sections may be offered by different faculty members. The selection of elective course by students will be based on first come first serve and / or CGPA criterion.

6.3 If the number of students registrations are more than the strength of one section, then it is choice of the concerned Department to offer the same course for more than one section based on the resources available in the department.

7.0 **Attendance requirements:**

7.1 A student shall be eligible to appear for the semester-end examinations, if the student acquires a minimum of 75% of aggregate attendance of all the courses for that semester.

7.2 Shortage of attendance in aggregate upto 10% (securing 65% and above but below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fee shall be payable for condoning of shortage of attendance as notified in the respective college websites.

7.4 **Two hours** of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course.

7.5 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

7.6 Students whose shortage of attendance is not condoned in any semester, are not eligible to take their semester-end examinations of that semester. They get detained and will not be promoted to the next semester. Their registration for that semester shall stand cancelled, including internal marks. They may seek re-registration for that semester in the next academic year.

7.7 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same semester

8.0 Criteria for Earning of Credits in a Course

8.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if the student secures not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that course.

8.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project / Industry Oriented Mini Project / Internship, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submit a report on Field-Based Research Project/Industry Oriented Mini Project/ Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Field-Based Research Project / Industry Oriented Mini Project / Internship evaluations.

8.3 A student eligible to appear in the semester-end examination for any course, is absent from it or failed (thereby failing to secure **'C'** grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary/make-up examination. If the student secures sufficient marks for passing, **'C'** grade or above shall be awarded as specified in clause 10.3.

9.0 Distribution of Marks and Evaluation

9.1 The performance of a student in every course (including Value Added Courses and Skill Development Courses, Laboratory/Practical and Project Work) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination), irrespective of the credits allocated.

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses:

For theory courses, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks, totaling to 30 marks. Total duration of mid-term examination is two hours.

1. Mid Term Examination for 30 marks:
   a. Part - A : Objective/quiz paper for 10 marks.
   b. Part - B : Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks.

The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics.

The remaining 10 marks of Continuous Internal Evaluation are distributed as follows:

2. Five marks for the assignment for 5 marks. Student shall submit two assignments and the **average of 2 Assignments** each for 5 marks shall be taken. The first assignment should be submitted before the conduct of the first mid-term examination, and the

second assignment should be submitted before the conduct of the second mid-term examination.

3. Five marks for the Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid-Term Examination. The HODs shall schedule these sessions in their semester plan.

9.2.2 Computer Aided Engineering Drawing Course: (CIE - 40 Marks)

For this course, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions**,** and another 20 marks will be allocated for the mid-term examination**.**
In the mid-term examination, students shall attempt any four out of six given questions.
The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (40 Marks)

9.2.3 Computer-Based Test (CBT) in each course is available for students who either:

1. Missed one of the two mid-term examinations due to unavoidable circumstances, or
2. Attended both mid-term examinations but wish to improve their internal marks.

The CBT will be conducted at the end of the semester and will carry a total of 30 marks. The marks obtained in the CBT will be considered equivalent to those obtained in one mid-term examination. Zero marks will be awarded to students who are absent from the mid-term examination. The average of the best two scores from the three exams (the two mid-term exams and the CBT), combined with other internal assessment components, will constitute the Continuous Internal Improvement (CII) marks for that specific course. CBT exams shall be conducted by the College.

9.3 Semester End Examination for theory courses

9.3.1 Theory Courses:

The semester end examinations (SEE), for theory courses, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks and ii) **Part - B** for 50 marks.

- Part-A is compulsory, consists of five short answer questions covering all units of syllabus; each question carries two marks.
- Part-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units.

9.3.2 Computer Aided Engineering Drawing Course:

Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units. There shall be no section with short answer questions.

9.3.3 Duration of SEE:

The duration of Semester End Examination of theory and drawing courses is 3 hours.

9.4 Semester End Examination for Practical Courses

For practical courses there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and semester-end examination for 60 marks. The breakup of the continuous internal evaluation for 40 marks is as follows:

1. 10 marks for a write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome).
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

3. 10 marks for the internal practical examination conducted by the laboratory teacher concerned.
4. The remaining 10 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination for practical courses shall be conducted with an external examiner and the laboratory course teacher. The external examiner shall be appointed from the college outside their cluster and not from a group colleges.

In the Semester End Examination for practical courses held for 3 hours, rubrics of evaluation for 60 marks is as given below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

For any change of experiment, 5 marks will be deducted from the total of 60 marks. If second time change of experiment is requested, another five marks will be deducted from the 60 marks. No third change will be permitted.

9.5 Field-based Research Project:

There shall be a Field-based Research Project in the intervening summer between II-II and III-I Semesters. Students will register for this project immediately after II Year II Semester examinations and pursue it during summer vacation. The Field-based Research Project shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The evaluation committee shall consist of an External Examiner, Head of the Department, Supervisor of the Project and a Senior Faculty Member of the department. There shall be no internal marks for Field-based Research Project. Student shall have to earn 40% marks, i.e 40 marks out of 100 marks. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the committee as per schedule, or (iii) secures less than 40% marks in this course.

9.6 Internship/Industry Oriented Mini Project:

There shall be an Internship/Industry Oriented Mini Project in collaboration with an industry from their specialization. Students shall register for this project immediately after III Year II Semester Examinations and pursue it during summer vacation. Internship should be carried out at an organization (or) Industry. The Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in IV Year I Semester before the semester end examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project/Internship, and a Senior Faculty Member of the Department.

9.6.1 For evaluating industry-oriented mini-projects, it is preferable to appoint an external examiner from the industry, ideally from one of the organizations/ industries with which the institute has established / proposing to establish collaborations.

9.7 UG Project Work:

9.7.1 The UG project work shall be initiated at the beginning of the IV Year II Semester and the duration of the project work is one semester. The student must present in consultation with his/her supervisor, the title, objective and plan of action of his/her Project work to the departmental committee for approval within two weeks from the commencement of IV Year II

Semester. Only after obtaining the approval of the departmental committee, the student can start his/her project work.

9.7.2 Student has to submit project work report at the end of IV Year II Semester. The project work shall be evaluated for 100 marks. Out of which 40 marks and 60 marks are allocated for CIE and External Evaluation respectively.

9.7.3 For internal evaluation, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 40 marks. The distribution of marks is as follows:

- Objective(s) of the work done - 05 Marks
- Methodology adopted - 15 Marks
- Results and Discussions - 15 Marks
- Conclusions and Outcomes - 05 Marks

Total - 40 Marks

9.7.4 The External Evaluation shall be conducted by the external examiner for a total of 60 marks. It shall comprise the presentation of the work, communication skills, and viva-voce, with a weightage of 20 marks, 15 marks, and 25 marks respectively.

The topics for main Project shall be different from the topic of Industry Oriented Mini Project/ Internship/SDC. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

9.7.5 For conducting viva-voce exam of project work, principal appoints an external examiner. The external examiner may be selected from the list of experts submitted by the HOD of the college.

9.7.6 A student who has failed, may re-appear once for the above evaluation, when it is scheduled again; if student fails in such 'one re-appearance' evaluation also, he/she has to appear for the same in the next subsequent year, as and when it is scheduled.

9.8 Skill Development Courses:

Four Skill Development Courses are included in the Curriculum in II-1, II-2, III-1 and III-2 semesters. Each Skill Development Course carries one credit. The evaluation pattern will be same as that of a laboratory course including the internal and external assessments.

The objective of Skill Courses is to develop the cognitive skills as well as the psycho-motor skills.

9.9 Value-Added Courses:

The evaluation of Value-Added Courses shall be similar to that of theory courses. However, the scheduling of these mid-term exams and semester-end examinations may not be combined with main-stream examinations. One hour /45 mins proctored mid-term examination shall be conducted in the regular class by the same subject teacher. It should not impact the conduct of other classes on that day.

The scheduling of the semester-end examinations shall also be intimated by the College time to time.

10.0 Grading Procedure

10.1 Absolute grading system is followed for awarding the grades to each course.

10.2 Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry-Oriented Mini Project/ Internship/ Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End

Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

10.3 To measure the performance of a student, a 10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

Range of % of Marks Secured in a Course	Letter Grade	Grade Points (GP)
Greater than or equal to 90	**O (Outstanding)**	**10**
80 and less than 90	**A^+ (Excellent)**	**9**
70 and less than 80	**A (Very Good)**	**8**
60 and less than 70	**B^+ (Good)**	**7**
50 and less than 60	**B (Average)**	**6**
40 and less than 50	**C (Pass)**	**5**
Below 40	**F (FAIL)**	**0**
Absent	**Ab**	**0**

10.4 A student shall be declared successful or 'passed' in a semester, if he/she secures **'C'** grade or above in every course (ie GP ≥ 5)

10.5 A student who has obtained an '**F'** grade in any course shall be deemed to have '**failed'** and is required to re-appear for a supplementary exam as and when conducted. In such cases, internal marks in those courses will remain the same as those obtained earlier.

10.6 To a student who has not appeared for an examination in any course, '**Ab'** grade will be allocated in that course, and he/she is deemed to have '**Failed'**. Such student will be required to re-appear for supplementary/make-up exam as and when conducted. The internal marks in those courses will remain the same as those obtained earlier.

10.7 The students earn a Grade Point (G) in each course, on the basis of letter grade secured in that course. Every student who passes a course will receive grade point **GP** ≥ **5** ('C' grade or above).

10.8 The 'Credit Points' (C) are computed by multiplying the grade point with credits for a given course.

Credit Points (C) = Grade Point (G) x Credits

10.9 The Semester Grade Point Average (SGPA) is calculated only when all the courses offered in a semester are cleared by a student. It is calculated by dividing the sum of credit points (ΣCG) secured from all courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA for each semester is thus computed as

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i \, G_i \} / \{ \sum_{i=1}^{N} C_i \}$$

where 'i' is the course indicator index (considering all courses in a semester), 'N' is the no. of courses registered for the semester (as listed under the course structure of the branch), C_i is the no. of credits allotted to the i^{th} course, and G_i represents the grade points corresponding to the letter grade awarded for that i^{th} course.

10.10 If a student earns more than 160 credits, only the courses corresponding to the best 160 credits shall be considered for the computation of CGPA of B.Tech. degree.

10.11 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student for the courses correspond to best 160 credits out of **all** registered courses in **all** semesters, and the total number of credits correspond to those selected courses. CGPA is rounded off to **two** decimal places. CGPA is thus computed at the end of each semester, from the I year II semester onwards, as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j \, G_j \} / \{ \sum_{j=1}^{M} C_j \}$$

where '**M'** is the total no. of courses corresponding to the best 160 credits from the courses registered in all eight semesters, 'j' is the course indicator index (takes into account all courses from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} course, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} course.

Illustration of the Calculation of SGPA:

Course	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	3	O	10	3 x 10 = 30
Course 3	3	C	5	3 x 5 = 15
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A	8	3 x 8 = 24
Course 6	2	A+	9	2 x 9 = 18
Course 7	1	C	5	1 x 5 = 5
Course 8	1	O	10	1 x 10 = 10
	20			152

SGPA = 152/20 = 7.6

The CGPA of the entire B.Tech. programme shall be calculated considering the best 160 credits earned by the student.

10.12 For merit ranking or comparison purposes or for any other listing, **only** the '**rounded off'** values of the CGPAs will be used.

10.13 SGPA of a semester will be mentioned in the semester Memorandum of Grades if all courses of that semester are cleared in first attempt. Otherwise, the SGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester.

11.0 Declaration of Results and issue of Grade Memo

11.1 While declaring the results, the web-version should display the marks earned by the students with the internal and external marks break-up. However, in the memorandum of grades, the marks need not be shown.

11.2 After the completion of each semester, a certificate of memorandum of grades shall be issued to all the registered students, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, course title, no. of credits), letter grade and credits earned.

12.0 Withholding of Results

12.1 If the student has not paid the fees to the College at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

13.0 Supplementary Examinations:

13.1 At the end of each semester, along with regular semester examinations, supplementary examinations shall be conducted for the students who have back-log subjects.

13.2 Advanced supplementary examinations in IV Year II Semester courses may be conducted for those who failed in any course offered in IV Year II Semester. It may enable the students to receive their B.Tech. provisional certificate at an early date. Advanced supply examinations may be scheduled within one month period after the declaration of the final semester results.

There shall be no supplementary examination in the successive semester. The students who could not secure any pass grade in advance supplementary examinations have to wait for regular series examination of next batch to write their back-log examination.

14.0 Promotion Rules

S.No.	Promotion	Conditions to be Fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester and fulfilment of attendance requirement.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester and fulfilment of attendance requirement (ii) **Must have secured at least 25% of the total** credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first semester and fulfilment of attendance requirement.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfilment of attendance requirement. (ii) **Must have secured at least 25% of the total credits** up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfilment of attendance requirement.
6	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfilment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfilment of attendance requirement.

15.0 Re-admission after Detention

i) A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.

ii) A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.

iii) When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to this student, not the academic regulations in which he got admitted in his/her first year of study.

16.0 Credit Exemption

A student (i) shall register for all courses covering 164 credits as specified and listed in the course structure and (ii) earn 160 or more credits to successfully complete the undergraduate programme.

- Best 160 credits shall be considered for CGPA computation. The student can avail exemption of courses ***totaling up to 4 credits*** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional drop out from these 164 credits registered;
- The semester grade point average (SGPA) of each semester shall be mentioned at the bottom of the grade card, when all the subjects in that semester have been passed by the student.
- Credits earned by the student in either a Minor or Honors program cannot be counted towards the required 160 credits for the award of the B.Tech. degree.

17.0 Award of Degree

17.1 A student who registers for all the courses specified in the course structure and secures the required number of 160 credits within 8 academic years from the date of commencement of the first academic year, shall be declared to have qualified for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

17.2 A student who qualifies for award of the degree as listed in item 17.1 shall be placed in the following classes.

17.3 A student with final CGPA (at the end of the undergraduate programme) ≥ 7.5, and fulfilling the following conditions - shall be placed in '**First Class with Distinction'**:

(i) Should have passed all the courses in '**First Appearance'**.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA ≥ 7.5 shall be

placed in **'First Class'.**

17.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.5 but < 7.5 shall be placed in **'First Class'.**

17.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 5.5 but < 6.5, shall be placed in '**Second Class'**.

17.6 All other students who qualify for the award of the degree (as per item 17.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 5.5, shall be placed in '**pass class**'.

17.7 Grace Marks

Grace marks shall be given to those students who complete the course work of four year B. Tech. degree, not secured pass grade in not more than three subjects and adding a specified grace marks enables the student to pass the subject(s) as well as gets eligibility to receive the provisional degree certificate.

Grace marks for students admitted under the R-25 Academic Regulations should not exceed **0.15%** of the total maximum marks in all eight semesters (excluding the marks allocated for value added courses and skill development courses).

18.0 Award of Gold Medals

18.1 Students fulfilling the conditions listed under item 17.3 alone will be eligible for award of '**Gold Medal**'.

18.2 If more than one student secures the same highest CGPA, then the following tie resolution criteria, in the same order of preference shall be followed for selecting the Gold Medal winner,

until the tie is resolved: 1) more number of times secured highest SGPAs, ii) more number of O and A+ grades in that order and iii) highest SGPA in the order of first semester to eight semester.

19.0 Conversion of CGPA into equivalent Percentage of Marks

19.1 The following formula shall be used for the conversion of CGPA into equivalent marks, whenever it is necessary

Percentage (%) of Marks = (Final CGPA – 0.5) x 10

20.0 Honours and Minor Degree Programs

Honours and Minor Degree programs will be available in all branches of B.Tech. degree. Minor Degree programs will commence from II Year II Semester and continue till IV Year I semester and Honours Degree programs will commence from III Year I Semester and continue till IV Year II semester.

21.0 Multiple Entry Multiple Exit Scheme (MEME)

21.1 Exit Option after Second Year:

Students enrolled in the 4-Year B.Tech. program are permitted to exit the program after successful completion of the second year (B.Tech. II Year II Semester). The students who desire to exit after the II year shall formally inform the exit plan one semester in advance i.e. at the commencement of II Year II Semester itself. Such students need to fulfil the additional requirements as specified in Clause 21.2 described below.

Upon fulfilling the requirements like earning all the credits up to II Year II Semester and successfully completing the additional requirements, the students will be awarded a 2-Year Undergraduate (UG) Diploma in the concerned engineering branch.

21.2 Additional Requirements for Diploma Award

To qualify for the diploma under the exit option, students must also complete 2 additional credits through one of the following college-prescribed pathways:

Work-based Vocational Course:

Participation in a practical, hands-on vocational training program relevant to the engineering field, typically conducted during the summer term.

Internship/Apprenticeship:

Completion of a minimum 8-week internship or apprenticeship in their related field to gain practical industry exposure.

In addition, students must clear any associated course(s) and submit the internship/ apprenticeship report as per the college's schedule and guidelines.

21.3 Re-entry into the B.Tech. Program

Students who have exited the B.Tech. program with a 2-Year UG Diploma may apply for re-entry into the Third Year (Fifth Semester) of the B.Tech. program. Re-entry is subject to the following conditions:

- The student must surrender the awarded UG Diploma Certificate.
- Students who wish to rejoin in III Year must join the same B.Tech. program and same college from which the student exited. Before rejoining, students should check for continuation of the same branch at the college. If the specific branch is closed in college,

then student should consult the college for the possible alternative solutions.

- Re-registered students will be governed by the academic regulations in effect at the time of re-entry, regardless of the original regulations under which they were admitted.
- If a student opts to continue his/her studies without a gap after being awarded the diploma, they must register for the third-year courses before the commencement of classwork.

21.4 Break in Study and Maximum Duration

Students are allowed to take a break of up to four years after completion of II Year II Semester with prior college permission through the Principal of the college.

Re-entry after such a break is subject to the condition that the student completes all academic requirements within twice the duration of the program (i.e., within 8 years for a 4-year B.Tech. program).

22.0 Transitory Regulations for the students re-admitted in R-25 Regulations:

22.1 Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech. programme, where R-25 regulations are in force.

22.2 A student detained due to shortage of attendance and re-admitted in R-25 regulations: Such students shall be permitted to join the same semester, but in R-25 Regulations.

22.3 A student detained due to shortage of credits and re-admitted in R-25 regulations: Such students shall be promoted to the next semester in R-25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/her previous semester.

22.4 A student who has failed in any course in a specific regulation has to pass those courses in the same regulations.

22.5 If a student is readmitted to R-25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in R-25 Regulations will be substituted by an equivalent course of R-22 regulations by the college. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

22.6 The R-25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech. degree within the stipulated period of eight academic years from the year of first admission.

23.0 Student Transfers

23.1 There shall be no branch transfers after the completion of admission process.

23.2 The students seeking transfer to college from various other Universities/institutions is having back-logs at the previous University/institute, have to pass the courses offered at MLRIT/JNTUH which are equivalent to the failed courses at the previous University/institute.

23.3 The transferred students from other Universities/Institutions to MLRIT, shall be given a chance to write CBTs for getting CIE component in the **equivalent course(s).**

24.0 Value Added Courses

24.1 Faculty members who have received a certificate in Innovation and Entrepreneurship / Entrepreneurship from a reputed foundation/organization may be given preference to teach the "Innovation and Entrepreneurship" course. This certificate course should include an assessment. Total training duration (online or physical), excluding assessment, should be at least 30 hours. Faculty members from all disciplines with innovative mindset and aptitude to co-create an entrepreneurial ecosystem are eligible to teach this subject.

24.2 Faculty members who have credited a course on Intellectual Property Rights in their UG or PG programme or credited an equivalent course in MOOCs platform/ reputed foundation/

organization in which assessment is a part, may be given preference to teach the elective course on Intellectual Property Rights.

24.3 To ensure quality delivery and standardization in teaching the **Indian Knowledge System (IKS)** and other value-added courses, the following guidelines must be adhered to: i) faculty members must undergo a Faculty Development Program (FDP) organized by UGC-MMTTC.(Malaviya Mission Teacher Training Centre), **or** Any other recognized and competent institution/organization offering similar certified programs, ii) the total instructional duration of the FDP should be a around 32 hours or more, III) all sessions in the FDP must be conducted by certified and qualified resource persons with recognized expertise in the respective domains, iv) A formal assessment component must be included as part of the FDP.

25.0 Mapping with the Sustainable Development Goals

All the courses specified in the course structure of every programme are mapped with the one or more sustainable development goals.

26.0 Scope

26.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

26.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

26.3 The college may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the college authorities.

26.4 Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

27.0 **Malpractice Prevention Committee**

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

a) Controller of examinations - Chairman
b) Addl. Controller of examinations.- Member Convener
c) Subject expert - member
d) Head of the department of which the student belongs to. - Member
e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

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MLR Institute of Technology

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME) FROM THE AY 2026-27

Eligibility for the award of B.Tech. Degree (LEs)

1. The LEs students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.
2. The student shall register for 123 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. programme (LEs) for the award of B.Tech. degree.
3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
4. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LEs).
5. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester	Regular course of study of second year first semester and fulfilment of attendance requirement.
2	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfilment of attendance requirement. (ii) Must have secured at least 25% of the total credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfilment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfilment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfilment of attendance requirement.

6. All the other regulations as applicable to B.Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
7. LES students are not permitted to exit the B.Tech. program after completion of second year (B.Tech. II Year II Semester).

Malpractices Rules
Disciplinary Action For / Improper Conduct in Examinations

Rule	Nature of Malpractices/ Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student 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 student orally or by any other body language methods or communicates through cell phones with any student 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 students 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 student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student 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 student is to be cancelled
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student 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 student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student 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 student 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 student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/COE/ACoE/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 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 student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student 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 student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses 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 student 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 student is also debarred and forfeits the seat.

9.	If student of the college, who is not a student 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.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student 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 student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the 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 student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for staff: (if the squad reports that the staff is also involved in encouraging malpractices)
   a. A show-cause notice shall be issued to the staff.
   b. Impose a suitable fine on the staff.

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COURSE STRUCTURE

MLR INSTITUTE OF TECHNOLOGY

B.Tech. in MECHANICAL ENGINEERING
COURSE STRUCTURE and SYLLABUS (R25 Regulations)
Applicable from AY 2025-26 Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7BS01	Matrices and Calculus	BSC	3	1	0	4
2.	A7BS10	Engineering Chemistry	BSC	3	0	0	3
3.	A7CS61	C Programming and Data Structures	ESC	3	0	0	3
4.	A7ME01	Engineering Mechanics	ESC	3	0	0	3
5.	A7EE09	Elements of Electrical and Electronics Engineering	ESC	3	0	0	3
6.	A7BS11	Engineering Chemistry Lab	BSC	0	0	2	1
7.	A7CS62	C Programming and Data Structures Lab	ESC	0	0	2	1
8.	A7ME03	Engineering Workshop	ESC	0	0	2	1
9.	A7EE10	Elements of Electrical and Electronics Engineering Lab	ESC	0	0	2	1
10.		Induction Program	-	-	-	-	-
		Total Credits		**15**	**01**	**08**	**20**

I YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7BS02	Ordinary Differential Equations and Vector Calculus	BSC	3	0	0	3
2.	A7BS08	Advanced Engineering Physics	BSC	3	0	0	3
3.	A7CS58	Python Programming	ESC	3	0	0	3
4.	A7HS01	English for Skill Enhancement	HSC	3	0	0	3
5.	A7ME04	Thermodynamics	ESC	3	0	0	3
6.	A7ME02	Computer Aided Engineering Drawing	ESC	2	0	2	3
7.	A7BS09	Advanced Engineering Physics Lab	BSC	0	0	2	1
8.	A7CS05	Python Programming Lab	ESC	0	0	2	1
9.	A7HS02	English Language and Communication Skills Lab	HSC	0	0	2	1
		Total Credits		**17**	**00**	**08**	**21**

II YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7BS04	Probability, Statistics and Complex Variables	BSC	3	0	0	3
2.	A7ME10	Mechanics of Solids	PCC	3	0	0	3
3.	A7ME11	Material Science and Metallurgy	PCC	3	0	0	3
4.	A7ME13	Production Technology	PCC	3	0	0	3
5.	A7ME15	Thermal Engineering - I	PCC	3	0	0	3
6.	A7BS07	Computational Mathematics Lab	BSC	0	0	2	1
7.	A7ME12	Mechanics of Solids and Material Science and Metallurgy Lab	PCC	0	0	2	1
8.	A7ME14	Production Technology Lab	PCC	0	0	2	1
9.	A7ME16	Thermal Engineering - I Lab	PCC	0	0	2	1
10.	A7ME17	**Design Thinking and Ideation**	SDC	0	0	2	1
		Total Credits		**15**	**0**	**10**	**20**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7HS06	**Business Economics and Financial Analysis**	HSC	3	0	0	3
2.	A7HS08	**Innovation and Entrepreneurship**	HSC	2	0	0	2
3.	A7ME20	Kinematics of Machinery	PCC	3	0	0	3
4.	A7ME21	Design of Machine Elements	PCC	3	0	0	3
5.	A7ME22	Fluid Mechanics and Hydraulic Machines	PCC	3	0	0	3
6.	A7ME24	Metrology and Machine Tools	PCC	2	0	0	2
7.	A7ME23	Fluid Mechanics and Hydraulic Machines Lab	PCC	0	0	2	1
8.	A7ME25	Metrology and Machine Tools Lab	PCC	0	0	2	1
9.	A7ME26	Computer Aided Machine Drawing	PCC	0	0	2	1
10.	A7DS30	Data Analytics and Python for Engineers	SDC	0	0	2	1
11.	A7HS05	**Indian Knowledge System**	HSC	1	0	0	1
		Total Credits		**17**	**0**	**8**	**21**

***Note:** Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

B.TECH I SEMESTER SYLLABUS

MATRICES & CALCULUS

I B.TECH – I SEMESTER: Common for All (ECE/EEE/MECH/AERO/ CSE/AI&ML//DS)

Course Code	Category	Hours/Week			Credits	MaximumMarks		
		L	T	P	C	CIE	SEE	Total
A7BS01	BSC	3	1	0	4	40	60	100

COURSEOUTCOMES:

After learning the contents of this paper, the student must be able to

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations.
2. Find the Eigenvalues and Eigen vectors, Reduce the quadratic form to canonical form using orthogonal transformations.
3. Solve the applications of the mean value theorems.
4. Find the extreme values of functions of two variables with/ without constraints.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I MATRICES

Rank of a matrix by Echelon form and Normal form –Inverse of Non-singular matrices by Gauss-Jordan method. System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations. Gauss Seidel Iteration Method.

UNIT-II EIGEN VALUES AND EIGEN VECTORS

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

UNIT-III SINGLE VARIABLE CALCULUS

Limit and Continuity of functions and its properties. Mean value theorems: Rolle's theorem – Lagrange's Mean value theorem with their Geometrical Interpretation and applications – Cauchy's Mean value Theorem – Taylor's Series (All theorems without proof).

Curve Tracing: Curve tracing in Cartesian coordinates.

UNIT-IV MULTIVARIABLE CALCULUS (PARTIAL DIFFERENTIATION AND APPLICATIONS

Definitions of Limit and continuity – Partial Differentiation: Applications of Euler's Theorem– Total derivative – Jacobian – Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V MULTIPLE INTEGRALS

Evaluation of Double Integrals (Cartesian and polar coordinates) – change of order of integration (only Cartesian form) – Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals, Applications: Areas by double integrals and volumes by triple integrals**.**

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, NarosaPublications, 5thEditon, 2016..

REFERENCEBOOKS:

1. ErwinKreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ENGINEERING CHEMISTRY

I B.TECH - I SEMESTER: AERO, CSE, CSD, CSM, EEE, ECE, MECH

Course Code	Category	Hours/Week			Credits	MaximumMarks		
		L	T	P	C	CIE	SEE	Total
A7BS10	BSC	3	0	0	3	40	60	100

COURSEOUTCOMES:

1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes.
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods.
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.
4. Students will learn the basic concepts and properties of polymers and other engineering materials.
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications.

UNIT-I WATER AND ITS TREATMENT

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion-exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT-II ELECTROCHEMISTRY AND CORROSION

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknown solution using SHE.

Corrosion: Introduction- Definition**,** causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT-III ENERGY SOURCES

Fuels: Introduction and characteristics of a good fuel, Calorific value – Units- HCV, LCV- Dulongs formula - Numerical problems.

Fossil fuels: Introduction, Classification, Petroleum- Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

UNIT-IV POLYMERIC MATERIALS

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.

Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between thermoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).

Conducting polymers: Definition and Classification with examples - Mechanism of conduction in trans-poly-acetylene and applications of conducting polymers.

Biodegradable polymers: Polylactic acid and its applications.

UNIT-V	ADVANCED FUNCTIONAL MATERIALS

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications.
Biosensor - Definition, Amperometric Glucose monitor sensor.
Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

TEXTBOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi,Dr.P.Aparna and Rath, Cengage learning, 2025.

REFERENCEBOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana& Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.

C PROGRAMMING & DATA STRUCTURES

I/I Semester: Common for AERO, MECH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7CS61	ESC	3	0	0	3	40	60	100

COURSE OUTCOMES:

1. To demonstrate the ability to write and understand basic C programs using language elements, variable declarations, arithmetic expressions, and control structures.
2. To develop programs using arrays, functions (including recursion), and pointers for modular and efficient coding.
3. To implement programs involving strings, structures/, and unions to solve real-time problems.
4. To demonstrate the use of Linked list, stack and queues for solving data-centric problems.
5. To apply basic searching and sorting algorithms and represent tree and graph structures using C.

UNIT-I INTRODUCTION TO C LANGUAGE AND CONTROL STRUCTURES

Introduction to C Language: Structure of C Program, Data Types, data input and output statements, Operators, Precedence and Associativity of operators, Evaluation of Expressions, Type Conversions in Expressions.
Control structures: Decision statements; if and switch statement; Loop control statements: while, for, and do while loops, jump statements: break, continue, goto statements.

UNIT-II ARRAYS, FUNCTIONS AND POINTERS

Arrays: Concepts, one-dimensional array, declaration and initialization of one-dimensional arrays, two-dimensional arrays, initialization and accessing.
Functions: Function definition, Types of Functions: User-defined and built-in Functions, Advantages of User-Defined Functions. Parameter passing in functions**:** Call by value, Call by reference, and Recursion.
Pointers: Pointer basics, Dynamic memory allocation.

UNIT-III STRINGS AND STRUCTURES

Strings: Arrays of characters, variable-length character strings, inputting character strings, character library functions, String Handling Functions, Arrays of Strings
Structures: Structure definition, initialization, accessing structures, Self-referential structures, Difference between structure and union.

UNIT-IV INTRODUCTION TO DATA STRUCTURES, STACK AND QUEUE

Introduction to Data Structures- Definition, Linear Data Structures, Non-Linear Data Structures
The Stack: Stack operations, implementing the Stack using Array, Stack Applications: Infix to Postfix conversion, Evaluating Postfix Expressions, **The Queue**: Queue operations, Implementing the Queue using Array.

UNIT-V LINKED LIST, SEARCHING AND SORTING, TREES AND GRAPHS

Linked List ADT - Singly Linked Lists (Insertion, Deletion and Traversing).
Basic Searching and Sorting Algorithms: Linear and Binary Search, Bubble Sort, Insertion Sort.
Trees –Terminology, Representation of Trees, **Graphs**: Introduction, Definition, Terminology

Text Books:

1. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
2. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rdedition, 2017.

Programming in C E. Balagurusamy Edition 3 Publisher Tata McGraw-Hill Publishing, 1990

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGrawHill
3. YashavantKanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, McGraw-Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

ENGINEERING MECHANICS

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7ME01	ESC	3	0	0	3	40	60	100

COURSE OUTCOMES: At the end of the course, students will be able to

1. Analyse problems involving force systems and rigid body equilibrium by applying fundamental mechanics principles, and equilibrium equations.
2. Apply principle of friction to static equilibrium problems on horizontal planes, inclined planes, ladders, wedges, and screw.
3. Determine centroids, centre of gravity, and moments of inertia (area and mass) for plane and composite sections.
4. Solve dynamics problems involving rectilinear and curvilinear motion by applying Newton's laws and principles of impulse, momentum.
5. Solve problems involving the motion and kinetics of rigid bodies such as plane motion, connected bodies, and rigid body rotation by applying D'Alembert's principle and the work-energy method to analyse forces, energy, and motion.

UNIT-INTRODUCTION TO ENGINEERING MECHANICS

Force Systems: Basic concepts, Rigid Body equilibrium, System of Forces, Parallelogram law, Coplanar Concurrent Forces, Resultant, Moment of Forces and its Application. Couples and Resultant of Force System: Equilibrium of Force Systems, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

UNIT-II: FRICTION AND APPLICATIONS OF FRICTION

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction. Motion of Bodies, Wedge Friction, Ladders, Screw Jack and Differential Screw Jack.

UNIT-III: CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centroid and Centre of Gravity: Centroid of Lines, Areas and Volumes from first principles, centroid of composite sections, Centre of Gravity and its implications.

Moment of Inertia: Definition, Area Moment of Inertia, Moment of inertia of Plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

Mass Moment of Inertia: Moment of Inertia of Masses, Radius of Gyration, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of composite bodies.

UNIT-IV: DYNAMICS OF A PARTICLE

Rectilinear motion, Plane curvilinear motion: Rectangular and Polar coordinates. Relative and constrained motion, Newton's law of motion for a particle (rectangular, path, and polar coordinates).

Impulse and momentum: Linear, Angular, Elastic Impact (Direct and oblique).

UNIT-V:KINETICS OF RIGID BODIES

Introduction, Types of motion, simple problems, D' Alembert's principle and its applications in plane motion and connected bodies.

Work-Energy Method: Work-Energy principle and its application in plane motion of connected bodies or Systems, Work energy Applied to particle motion, Kinetics of rigid body rotation

TEXT BOOKS:

1. Singer's Engineering Mechanics – Statics and Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar. B.S Publications, 3rd Edition, Rpt. 2024.
2. Engineering Mechanics, Shames and Rao, Pearson Education, 1st Edition, 2005

REFERENCE BOOKS:

1. Vector Mechanics for Engineers – Statics and Dynamics, Beer F.P and Johnston E.R Jr., Mc Graw Hill, 12th Edition, 2019.
2. Engineering Mechanics, Dumir P.C, Sengupta and Srinivas, Universities Press, 1st Edition, 2020.
3. Engineering Mechanics, Hibbeler R.C, Pearson, 14th Edition, 2017.

ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE09	ESC	3	0	0	3	40	60	100

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

1. Evaluate current and voltage values in resistive circuits with independent sources.
2. Explain the working of DC machines and solve the numerical problems
3. Design Basic Electrical Circuits and Install Electrical Wiring Systems
4. Analyze the V-I characteristics of PN – junction diode and describe the operation of rectifiers.
5. Analyze the different configurations of Transistors and obtain its characteristics.

UNIT-I: DC & AC CIRCUITS

D.C. CIRCUITS: Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

A.C. CIRCUITS: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, power and power factor, Series and parallel resonance of RLC Circuit. Elementary concepts of three phase systems: Three phase star and delta supply system, Line and Phase quantities for balanced circuits.

UNIT-II: ELECTRICAL MACHINES

ELECTRICAL MACHINES: Construction and working principle of DC generators, EMF equation, working principle of DC motors, working principle of Single-phase transformer, EMF equation, losses in transformers, efficiency. Construction and working principle of three phase Induction motor and synchronous generators. (Elementary Treatment Only)

UNIT-III: ELECTRICAL INSTALLATIONS

ELECTRICAL INSTALLATIONS: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Types of Batteries, Important Characteristics for Batteries.

UNIT-IV:P-N JUNCTION DIODE & APPLICATIONS

P-N JUNCTION DIODE & APPLICATIONS: Principle of Operation, Diode equation, VI characteristics, Ideal versus practical, Static and dynamic resistances. Rectifiers and Filters: P-N junction diode as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier with and without capacitor filter.

UNIT-V: BIPOLAR JUNCTION TRANSISTOR (BJT) & APPLICATIONS

BIPOLAR JUNCTION TRANSISTOR (BJT) & APPLICATIONS: Construction, Principle of Operation, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. Transistor as a Switch and Amplifier.

TEXT BOOKS:

1.Basic Electrical and electronics Engineering, D P Kothari and I J Nagarath, McGraw Hill Education, 2nd Edition, 2020.

2.Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010

REFERENCE BOOKS:

1.Millman's Electronic Devices and Circuits,J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.

2. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.

ENGINEERING CHEMISTRY LAB

I SEMESTER: AERO, CSE, CSD, CSM, EEE, ECE, MECH

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7BS11	BSC	0	0	2	1	40	60	100

COURSE OUTCOMES:

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering.
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.
5. Students will understand the working principle of colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law).

LIST OF EXPERIMENTS

List of Experiments:

I. Water Analysis:

1. Estimation of Hardness of water by EDTA Complexometry method.
2. Determination of Alkalanity of given water sample.

II. Conductometry:

1. Estimation of the concentration of strong acid by Conductometry.
2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.

III. Potentiometry:

1. Estimation of concentration of Fe^{+2}ion by Potentiometry using $KMnO_4$.

IV. pH Metry: Determination of an acid concentration using pH meter.

V. Colorimetry: Verification of Lambert-Beer's law using $KMnO_4$.

VI. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon – 6, 6.

VII. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VIII. Virtual lab experiments:

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCEBOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

C PROGRAMMING & DATA STRUCTURES LAB

I - I Semester: Common to AERO and MECH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7CS62	ESC	0	0	2	1	40	60	100

COURSE OUTCOMES:

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

1) Correct syntax errors as reported by the compilers and logical errors encountered at run time Develop programs by using decision making and looping constructs.
2) Implement real time applications using the concept of array, pointers, functions and structures.
3) Develop programs to perform different operations on files in c.
4) Design and Implement operations on data structures like Linked list, Stack and Queue.

LIST OF EXPERIMENTS

Week-1 BASIC DATA TYPES

1. Swapping for Rohan

Rohan mistakenly stored two numbers in reverse order. Without using any temporary variable, help him correct the order by swapping the two numbers.

2. Expression Help for Sneha

Sneha is working on her math homework and gives you three values x, y, and z. She wants you to calculate and print the result of the following expressions:

1. (x + y + z) / (x − y − z)
2. (x + y + z) / 3
3. (x + y) × (x − y) × (y − z)

3. Circle Trouble for Kavya

Kavya is designing circular coasters and needs to calculate the area and perimeter of a circle based on the radius she inputs. Help her with the calculations. Use π = 3.14.

4. Electricity Bill for Mr. Sharma

Mr. Sharma owns a small printing press. His electricity meter shows the number of units consumed and he also knows the cost per unit. Help him find out the total bill amount.

Week-2 CONDITIONAL STATEMENTS

1. Grading Sheet for Ravi

Ravi wants an automated system to assign grades based on the marks he enters. The grading system is as follows:
- Below 50 → F
- 50–59 → C
- 60–69 → B
- 70–79 → B+
- 80–89 → A
- 90–100 → A+

2. Mini Calculator for Meera

Meera needs a simple calculator that can perform basic arithmetic operations: addition, subtraction, multiplication, division, and modulus. She provides two numbers and an operator.

Week-3	LOOPING STATEMENTS

1. Fibonacci Help for Anjali
Anjali is trying to generate the Fibonacci series for her math assignment. Help her display the first `n` terms.

2. Palindrome Check for Raj
Raj enters a number and wonders if it's a palindrome — a number that reads the same backward as forward. Help him verify it.

3. Pascal's Triangle for Swetha
Swetha wants to print Pascal's Triangle up to a given number of rows. Help her visualize the triangle in standard format.

4. Number Pyramid for Ramesh
Ramesh loves patterns. He gives a number `n` and expects a number pyramid starting from 1 and increasing row-wise.

Week-4	ARRAYS

1.Search Quest for Nisha
Nisha is working on a project that involves searching for a specific number in a list. Help her implement both Linear and Binary Search to locate the number.

2.Matrix Magic for Aryan
Aryan is working on a magic square problem. Help him add and multiply two matrices of size `n × n`.

Week-5	FUNCTIONS

1.Factorial Finder for Leela
Leela wants to calculate factorial of a number both recursively and non-recursively.

2.Power & GCD Helper for Raju

- Raju is practicing problems on functions. Help him compute:
  1. Power of a number
  2. GCD of two numbers

Week-6	STRINGS

1.String Tricks for Diya
Diya needs to modify a string based on given operations.

2.String Analyzer for Akash
Akash is learning string functions. Help him analyze a string using: `strlen`, `strrev`, `strcpy`, `strcmp`, and `strcat`.

Week-7	POINTERS

1.Reverse Array for Mohan
Mohan wants to reverse the contents of an array using pointers.

2.Dynamic Swap for Preeti
Preeti wants to swap two integers dynamically using `malloc` and pointers.

Week-8	STRUCTURES

1.Complex Math for Rahul
Rahul is handling complex numbers. Help him implement addition and multiplication using structures.
2.Employee Info for Sheela
Sheela is managing employee records. Each employee has id, name, basic, hra, and da. Help her

Week-9	STACK & QUEUE OPERATIONS

1.Write a C program that implement Stack (its operations) using array

Problem Description:

Ajay is managing data using a stack. Each stack can hold integers and perform common operations like **push**, **pop**, and **display**. Help him implement a stack using an array in C.
2.Write a C program that implement Queue (its operations) using array.

Problem Description:

Neha is organizing customer service requests using a queue. Each request is added at the rear and handled from the front. Help her implement a **Queue using an array in C** with the following operations:

- enqueue x → Insert x into the queue
- dequeue → Remove front element
- display → Show all queue elements from front to rear

Week-10	SINGLY LINKED LIST

1.Single Linked List:
Problem Description:
Ravi is maintaining student records using a **singly linked list**. Each node stores a student's roll number. Help him manage the list using a C program that performs the following operations:

- create x → Creates the first node with value x
- insert x → Inserts a new node at the end
- delete x → Deletes the node containing x
- traverse → Displays all node values in order

Week-11	SEARCHING TECHNIQUES

1.Linear Search
Problem Description:
Priya is working with student scores and needs to check whether a specific score exists in the list. Help her implement a program that performs **Linear Search** using C to find the required score.
2.Binary Search:
Problem Description:
Anjali is organizing a list of book IDs in ascending order. She wants to quickly find out whether a particular book ID exists in the list. Help her implement a **Binary Search using C** to efficiently search for a given value.

Week-12	SORTING TECHNIQUES

1.Bubble Sort:

Problem Description:
Karan is organizing a list of numbers and wants to sort them in ascending order using the **Bubble Sort** algorithm. Help him implement the sorting program in C.

2.Insertion Sort:

Problem Description:
Riya is arranging a list of numbers and wants to sort them in ascending order using the **Insertion Sort** algorithm. Help her implement the sorting program in C.

Text Books:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
YashavantKanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.

Reference Books:

1. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018
2. King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
3. Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
4. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.

ENGINEERING WORKSHOP

COMMON TO ALL BRANCHES

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7ME03	ESC	0	0	2	1	40	60	100

Prerequisites: Practical skill

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

1. Identify and effectively use common tools and equipment for operations such as fitting, carpentry, welding, and machining.
2. Interpret basic engineering drawings and manufacture components as per the given specifications.
3. Acquire practical skills in producing simple components using various workshop techniques.
4. Analyze the operational procedures involved in carpentry, fitting, welding, sheet metal work, and machining.
5. Apply workshop knowledge to design and assemble simple models, improving problem-solving and teamwork abilities.

LIST OF EXPERIMENTS

List of Experiments:

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

i. **Carpentry:** T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
ii. **Fitting:** V- Fit, Dovetail Fit and L - fit
iii. **Tin Smithy**: Square Tin, Rectangular Tray and Conical Funnel
iv. **Soldering**: Parallel and Series, Wheat stone bridge circuit.
v. **House wiring**: Parallel and Series, Two-way Switch and Tube Light

2. TRADES FOR DEMONSTRATION AND EXPOSURE:

Black Smithy: Round to Square and S – Hook
Plumbing: PVC Pipe Fittings

TEXTBOOKS:

1. Workshop Practice, B. L. Juneja, Cengage Learning India, 1st edition, 2015.
2. Workshop Practice Manual, K. Venkata Reddy, BS Publication,6th Edition, Rpt.2025.

REFERENCEBOOKS:

Workshop Manual, K. Venugopal, Anuradha Publications, 2012th edition, 2012.

ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB

I B. Tech. I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE10	ESC	0	0	2	1	40	60	100

Prerequisites: Basic Electrical and Electronics Engineering

COURSEOUTCOMES:

1. Analyze the circuit using Kirchhoff's law and network simplification theorems
2. Analyze and solve for current and frequency values of R-L-C circuits with AC Excitations.
3. Evaluate the efficiency and critical speed and critical field resistance of DC Machine, Evaluate the efficiency of AC Machine
4. Evaluate the efficiency of Rectifier also plot the input and output characteristics of Transistors.

LIST OF EXPERIMENTS

PART-A:ELECTRICAL

1.Verification of KVL and KCL

2.Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-phase Transformer

3.Series and parallel resonance of RLC Circuits.

4.Magnetization characteristics of DC Shunt Generator

5.Performance Characteristics of a Self-excited DC Shunt Motor

6.Performance Characteristics of a Three phase Induction Motor

PART-B:ELECTRONICS

1. Study and operation of (i) Multimeters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.

2.P-N Junction diode characteristics

3.Zener diode characteristics

4.Input and Output characteristics of Transistor in CB configuration

5.Input and Output characteristics of Transistor in CE configuration

6.Full Wave Rectifier with and without filters

TEXT BOOKS:

1.Basic Electrical and electronics Engineering, M.S. Sukija and T.K .Nagasarkar, Oxford University press, 1st Edition, 2012.

2. Basic Electrical and electronics Engineering, D.P. Kothari and I.J.Nagarath, McGraw Hill Education, 2nd Edition, 2020.

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R.L.Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.

2.Millman's Electronic Devices and Circuits, J. Millman,C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.

3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.

4.Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press 2nd Edition, 2004

5.NetworkTheory,N.C.JaganandC.Lakshminarayana,McGrawHill,2nd Edition,2005

6.Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.

B.TECH II SEMESTER SYLLABUS

ORDINARY DIFFERNTIAL EQUATIONS AND VECTOR CALCULUS

I Year II Semester: Common for All (ECE/EEE/MECH/AERO/ CSE/AI&ML/DS)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7BS02	BSC	3	0	0	3	40	60	100

COURSE OUTCOMES: After learning the contents of this paper, the student must be able to

1. Determine whether the given differential equation of first order is exact or not.
2. Solve higher order differential equations and apply the concept of differential equations to real world problems.
3. Evaluate Ordinary differential equations using Laplace transforms.
4. Compute the gradient of a scalar field and evaluate directional derivatives at given points.
5. Evaluate the Line, Surface and Volume integrals and converting them from one to another.

UNIT-I FIRST ORDER ORDINARY DIFFERNTIAL EQUATIONS

Exact differential equations – Equations reducible to exact differential equations – linear and Bernoulli's equations – Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling – Law of natural growth and decay.

UNIT-II ORDINARY DIFFERNTIAL EQUATIONS OF HIGHER ORDER

Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)$ and $x\,V(x)$– Method of variation of parameters.

UNIT-III LAPLACE TRANSFORMS

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – Evaluation of improper integrals by Laplace transforms – Laplace transform of periodic functions – Inverse Laplace transforms - partial fractions, First shifting theorem, derivatives and integrals,, convolution theorem. Applications: solving Initial value problems of ODE by Laplace transform method (All theorems / Properties without proof).

UNIT-IV VECTOR DIFFERENTIATION

Vector point functions and scalar point functions – Gradient – Directional derivatives - Divergence and Curl — Solenoidal and Irrotational vectors - Scalar potential functions –Vector operators and Identities.

UNIT-V VECTOR INTEGRATION

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5thEditon, 2016.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ADVANCED ENGINEERING PHYSICS

I B. Tech II Sem : Common to all branches [CSE, CSE(AI & ML, DS) CSD, ECE, EEE, MECH, AERO]

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS08	BSC	3	0	0	3	40	60	100

COURSEOUTCOMES:

CO1: Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
CO2: Apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
CO3: Apply quantum gates (Pauli –X, Y, Z, Hadamard, CNOT, SWAP) to construct basic quantum circuits for simple computational tasks.
CO4: Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
CO5: Explain the principles of lasers and fibre optics and their applications in communication and sensing.

UNIT-I:CRYSTALLOGRAPHY & MATERIALS CHARACTERIZATION

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects: Schottky and Frenkel defects, concept of nanomaterials: surface to volume ratio, X -ray diffraction: Bragg's law, powder method, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT-II: QUANTUM MECHANICS

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics (qualitative), eigen values and eigen functions, expectation value (qualitative); Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

UNIT-III: QUANTUM COMPUTING

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates (Pauli-X, Y, Z, Hadamard, CNOT, SWAP), challenges and advantages of quantum computing over classical computation, : quantum algorithms: Deutsch-Jozsa, Grover.

UNIT-IV: MAGNETIC AND DIELECTRIC MATERIALS

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferrimagnetic materials using sol-gel method, applications: magnetic hyperthermia for cancer treatment, magnets for EV.
Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

UNIT-V: LASER AND FIBRE OPTICS

Introduction to laser, characteristics of laser, spontaneous and stimulated emission, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, CO_2 laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.
Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres-Step index, Graded Index, single mode step index, multimode step index, multimode graded index, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

TEXT BOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

REFERENCE BOOKS:

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

PYTHON PROGRAMMING

I/II Semester: ECE/AERO/MECH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7CS58	ESC	3	0	0	3	40	60	100

COURSE OUTCOMES :

1. Write Python programs using variables, operators, expressions, and control structures.
2. Implement Python programs using built-in data structures like lists, tuples, sets, and dictionaries.
3. Apply modular and object-oriented programming principles in Python.
4. Handle files, exceptions, and apply Python libraries for problem-solving.
5. Develop small-scale applications in Python for automation and data manipulation.

UNIT-I INTRODUCTION TO PYTHON AND BASICS OF PROGRAMMING

Introduction to Python: Features, Applications, Installation, IDEs, Python Syntax, Indentation, Comments, Variables, Data Types, Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Membership, Identity, Bitwise, Input/Output functions (input(), print()), Control Structures: if, if-else, if-elif-else, Nested Conditions, Looping: for, while, Nested Loops, break, continue, pass.

UNIT-II DATA STRUCTURES IN PYTHON

Strings: Creation, Indexing, Slicing, Methods, String Formatting, Lists: Creation, Indexing, Slicing, List Comprehension, Methods, Tuples: Properties, Indexing, Methods, Sets: Creation, Operations, Methods, Dictionaries: Creation, Access, Methods, Dictionary Comprehension, Iterating over data structures.

UNIT-III FUNCTIONS AND MODULES

Functions: Defining, Calling, Parameters, Return Values, Types of Arguments: Positional, Keyword, Default, Variable Length, Scope of Variables: Local and Global, Lambda Functions, Map, Filter, Reduce, Recursion in Python, Modules: Importing, Creating User-defined Modules, Standard Modules (math, random, date-time), Packages in Python.

UNIT-IV FILE HANDLING AND EXCEPTION HANDLING

File Handling: Opening, Reading, Writing, Appending, File Modes, File Methods, Working with CSV and JSON Files, Exception Handling: try, except, else, finally, Built-in Exceptions, Raising Exceptions, Introduction to Regular Expressions (re module).

UNIT-V OBJECT-ORIENTED PROGRAMMING AND APPLICATIONS

OOP Basics: Classes, Objects, Attributes, Methods, Constructor (__init__), self keyword, Inheritance: Single, Multiple, Multilevel, Hierarchical, Method Overriding, Method Overloading (conceptual), Encapsulation and Polymorphism, Application Development: Data Processing Script, Basic Calculator, File Organizer, Simple Data Analysis with pandas.

TEXT BOOKS:

1. Python Programming: Using Problem Solving Approach by Reema Thareja.
2. Python Crash Course by Eric Matthes, Learning Python by Mark Lutz.

REFERENCE BOOKS:

1. Introduction to Python Programming by Gowrishankar S., Veena A.
2. Python Cookbook by David Beazley and Brian K. Jones.
3. Fluent Python by Luciano Ramalho, Automate the Boring Stuff with Python by Al Sweigart.

ENGLISH FOR SKILL ENHANCEMENT

I YEAR II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7HS01	HSC	3	0	0	3	40	60	100

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

COURSE OUTCOMES

Students will be able to:

1. Students will be able to remember, understand, and apply an expanded range of vocabularies and their usages to comprehend texts and communicate ideas effectively in various academic, social, and professional contexts.
2. Students will be able to apply grammatical rules to produce error-free sentences for effective oral and written communication skills n professional and personal setups.
3. Students will be able to apply effective reading strategies such as skimming and scanning to extract essential information from texts and demonstrate improved comprehension.
4. Students will be able to compose well-structured and coherent written documents such as paragraphs, essays, letters, emails, reports, and resumes for academic and professional purposes
5. Students will be able to analyze and compare textual themes in relation to their socio-cultural and ethical contexts, and critically reflect on their implications.

UNIT-I

Theme: Perspectives

Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

UNIT-II	SECOND LAW OF THERMODYNAMICS AND AVAILABILITY
Theme: Digital Transformation **Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.**	
Vocabulary:	Homophones, Homonyms and Homographs
Grammar:	Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading:	Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice
Writing:	Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.
UNIT-III	
Theme: Attitude and Gratitude **Poems on '*Leisure*' by William Henry Davies and '*Be Thankful*' - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.**	
Vocabulary:	Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar:	Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading:	Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.
Writing:	Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.
UNIT-IV	
Theme: Entrepreneurship **Lesson on '*Why a Start-Up Needs to Find its Customers First*' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.**	
Vocabulary:	Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.
Grammar:	Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.
Reading:	Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice
Writing:	Writing Practices- Note Making-Précis Writing.
UNIT-V	
Theme: Integrity and Professionalism **Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.**	
Vocabulary:	Technical Vocabulary and their Usage– One Word Substitutes – Collocations.
Grammar:	Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading:	Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice
Writing:	***Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.***

Text Books:

1. **Board of Editors. *2025. English for the Young in the Digital World.* Orient BlackSwan Pvt. Ltd.**

Reference Books:

1. Swan, Michael. (2016). *Practical English Usage*. Oxford University Press. New Edition.
2. *Karal, Rajeevan. 2023. English Grammar Just for You.* Oxford University Press. New Delhi
3. 2024. *Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar &Pushp Lata. 2022. *Communication Skills – A Workbook*. Oxford Univeristy Press. New Delhi
5. Wood,F.T. (2007). *Remedial English Grammar*. Macmillan.
6. Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students.* Mc Graw-Hill Education India Pvt. Ltd.

THERMODYNAMICS

I YEAR II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7ME04	ESC	3	0	0	3	40	60	100

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

1. Apply basic thermodynamic properties, processes, work, heat, Zeroth Law, and First Law to analyze energy interactions in closed systems and steady flow processes using the Steady Flow Energy Equation
2. Apply Second Law, Carnot cycle, entropy principle, and thermodynamic potentials to evaluate system performance, energy availability, and irreversibility in thermodynamic processes.
3. Apply properties of pure substances and perfect gases to analyze phase-change processes and energy interactions in closed and flow systems.
4. Apply real gas models and perfect gas mixture relations to determine thermodynamic properties and performance parameters.
5. Apply psychrometric properties and psychrometric charts to evaluate air-water vapor mixture properties and analyze air conditioning/drying processes

UNIT-I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium State, Property, Process, Exact and Inexact Differentials, Cycle, Reversibility, Quasi – static Process, Irreversible Process, Causes of Irreversibility, Energy in State and in Transition, Types, Displacement and Other forms of Work, Heat Point and Path functions, Zeroth Law of Thermodynamics, Concept of Temperature, PMM - I, Joule's Experiments, First law of Thermodynamics, Corollaries, First law applied to a Process, applied to a flow system, Steady Flow Energy Equation.

UNIT-II SECOND LAW OF THERMODYNAMICS AND AVAILABILITY

Limitations of the First Law, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin, Planck and Clausius Statements and their Equivalence , Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT-III PURE SUBSTANCE AND PERFECT GAS

Pure Substances: P - V- T surfaces, T- S and h- s diagrams, Mollier Charts, Phase Transformations: Triple point at critical state properties during change of phase, Dryness Fraction, Clausius - Clapeyron Equation, Property tables and application of these concepts in various thermodynamic processes, Steam calorimetry.

Perfect Gas: Perfect Gas Laws, Equation of State, Specific and Universal Gas constants, various Nonflow processes, Properties, end states, Heat and Work Transfer, changes in Internal Energy, Throttling and Free Expansion Processes, Flow processes.

UNIT-IV REAL GAS MODELS AND PERFECT GAS MIXTURES

Real Gas Models: Deviations from perfect Gas Model, Vader Waals Equation of State, Compressibility charts, variable specific Heats, Gas Tables.

Mixtures of perfect Gases: Mole Fraction, Mass friction Gravimetric and volumetric Analysis. Dalton's Law of

partial pressure, Avogadro's Laws of additive volumes. Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour.

UNIT-V	PSYCHROMETRY

Atmospheric air, Psychrometric Properties, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation, Adiabatic Saturation, Carrier's Equation, Psychrometric chart.

TEXT BOOKS:

1. Engineering Thermodynamics, P.K. Nag, Mc Graw Hill, 7th Edition, 2020.
2. Fundamentals of Thermodynamics, Richard E. Sonntag and Claus Borgnakke, Wiley, 8th Edition, 2014.

REFERENCE BOOKS:

1. Thermodynamics, Yunus A Cengel, Michael A Boles, Mehmet Kanoglu, McGraw-Hill, 9th Edition, 2019.
2. Thermodynamics, J.P. Holman, McGraw Hill Education, 10th Edition, 2010.
3. Engineering Thermodynamics, Chattopadhyay, Oxford, 2nd Edition, 2015.

COMPUTER AIDED ENGINEERING DRAWING

I B. Tech. II Sem: Common to all branches

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7ME02	ESC	2	0	2	3	40	60	100

COURSEOUTCOMES:

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

1. Explain various commands and create 2D Engineering Drawings using AutoCAD.
2. Construct the various curves used for engineering applications
3. Prepare orthographic projections of lines, planes by visualizing them in different positions.
4. Solve the problems of projections of solids and development of surfaces for industrial needs.
5. Construct the isometric view into orthographic views and vice versa.

UNIT-I:INTRODUCTION TO ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING

Introduction to Engineering Drawing: Principles and their significance,
Introduction to Computer Aided Drafting: Initial Setup Commands, Draw Commands, Modify Commands, 2D Drawings - Simple Exercises.

UNIT-II:ENGINEERING CURVES

Engineering Curves: Ellipse, Parabola, and Hyperbola (General Method only).
Special curves: Cycloid, Epi-cycloid, Hypocycloid and Involutes (simple Exercises).

UNIT-III:PROJECTIONS OF POINTS, LINES AND PLANES

Principles of Orthographic Projections: Conventions, First and Third angle projections.
Projections of points, Projection of Lines inclined to both the planes.
Projections of Planes: Projections of regular planes inclined to both planes

UNIT-IV: PROJECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES

Projection of Solids: Regular Solids inclined to both planes (Prisms, Pyramids, Cylinders and Cone).
Development Of Surfaces: Theory of development, development of lateral surface with base (Prisms, Pyramids, Cylinders and Cone).

UNIT-V: ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non, isometric lines. Isometric Projection of Spherical Parts.
Conversion of Isometric view to Orthographic views and Orthographic views to isometric view.

TEXT BOOKS:

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rd Edition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rdEdition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009

ADVANCED ENGINEERING PHYSICS LAB

I YEAR II Semester: Common to all branches [CSE, CSE(AI & ML, DS), ECE, EEE, MECH, AERO]

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7BS09	BSC	0	0	2	1	40	60	100

COURSE OUTCOME:

CO1: Synthesize and analyze nanomaterials such as magnetite (Fe_3O_4) using chemical methods.

CO2: Determine electrical, magnetic, dielectric, optical properties of functional materials and validation of quantum theory of radiation.

CO3: Characterize semiconductors using Hall effect and energy gap measurement techniques.

CO4: Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.

CO5: Apply scientific methods for accurate data collection, analysis, and technical report writing.

LIST OF EXPERIMENTS

1. **Magnetite Powder:** To synthesize magnetite (Fe_3O_4) powder using sol-gel method (CO1)
2. **Energy gap of a semiconductor:** To determine the energy gap of a given semiconductor (CO3)
3. **Hall Effect:** To determine the Hall coefficient and carrier concentration of a given semiconductor. (CO3)
4. **Magnetic Moment:** To determine the magnetic moment of a bar magnet and horizontal earth magnetic field. (CO2)
5. **B-H Curve:** To study of B-H curve of a ferro magnetic material (CO2)
6. **Stewart Gee's Experiment:** To study the variation of magnetic field along the axis of a circular coil and calculation of magnetic flux. (CO2)
7. **Dielectric constant:**To determine the dielectric constant of a given material (CO2)
8. **Planck's Constant:** To determine value of Planck's constant by measuring radiation in fixed spectral range. (CO2)
9. **(a) Wavelength of Laser:** To determine the wavelength of a laser using diffraction grating (CO4)

   (b) V-I and L-I characteristics: To study of V-I & L-I characteristics of a given laser diode (CO4)
10. **(a)Numerical Aperture:** To determine the numerical aperture of a given optical fiber (CO4)

    (b) Bending Loss: To determine the bending losses of a given optical fiber (CO4)
11. **Physics Project**: Students are required to design a prototype based on one of the above experiments no 1-10 (CO5).

(Note: Any 8 experiments are to be performed.)

PYTHON PROGRAMMING LAB

I B.TECH –II SEMESTER: Common to All branches

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7CS05	ESC	0	0	2	1	40	60	100

COURSE OUTCOMES:

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

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python
3. Verify programs using modular approach, file I/O, Python standard library
4. Implement Digital Systems using Python

LIST OF EXPERIMENTS

WEEK-I

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii)Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.

WEEK-2

1. Write a program to calculate compound interest when principal, rate and numbers of periods are given.
2. Read the name, address, email and phone number of a person through the key board and print the details.
3. Print the below triangle using for loop.

```
5
44
333
2222
11111
```

WEEK-3

1. Write a program to check whether the given input is digit or lower case character or uppercase character or a special character(use 'if-else-if' ladder)
2. Python program to print all prime numbers in a given interval (use break)
3. Write a program to convert a list and tuple into arrays.

WEEK-4

1. Write a program to find common values between two arrays.
2. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.
3. Write a function called is sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.

WEEK-5		
1. Write a function called has duplicates that take a list and returns True if there is any element that appears more than once. It should not modify the original list. 2. Write a function called remove duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order. 3. The word list I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.		
WEEK-6		
1. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys. 2. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e' Remove the given word in all the places in a string? 3. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lowercase without using a built-in function?		
WEEK-7		
1. Write a recursive function that generates all binary string so fn-bit length 2. Write a python program that defines a matrix and prints 3. Write a python program to perform multiplication of two square matrices		
WEEK-8		
1. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions. 2. Use the structure of exception handling all general-purpose exceptions. 3. Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.		
WEEK-9		
1. Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color. 2. Write a function called draw point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas. 3. Define an ew class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw circle that draws circles on the canvas.		
WEEK-10		
1. Write a python code to read a phone number and email-id from the user and validate it for correctness. 2. Write a Python code to merge two given file contents into a third file. 3. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.		
WEEK-11		
1. Write a Python code to Read text format ext file, find the word with most number of occurrences 2. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters. 3. Import numpy, Plotpy and Scipy and explore their functionalities.		
WEEK-12		
1. Install NumPy package with pip and explore it. 2. Write a program to implement Digital Logic Gates–AND,OR, NOT,EX-OR 3. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.		

TEXT BOOKS

1. Supercharged Python: Take your code to the next level, Over land
2. Learning Python, Mark Lutz, O'reilly

REFERENCEBOOKS

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Introduction to Python Programming, Gowrishakar S,Veena A,CRC Press
4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
5. Python for DataScience, Dr.Mohd Abdul Hameed, Wiley publications
6. Core Python Programming, Dr.R.Nageswara Rao,Dreamtech press
7. Introduction to Python, Gowrishankar S, Veena A.,CRC Press

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I YEAR II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A7HS02	HSC	0	0	2	1	40	60	100

The English Language and Communication Skills (ELCS) Lab focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

COURSE OUTCOME:

Students will be able to:

1. Demonstrate improved listening skills and comprehend English spoken in native accents with enhanced focus and accuracy.
2. To apply appropriate pronunciation, intonation, and stress patterns while speaking English through participating in structured and spontaneous speaking activities.
3. Interpret and analyze a variety of written texts accurately using effective reading strategies.
4. Compose clear, coherent, and grammatically correct written texts for academic and professional purposes

LIST OF EXPERIMENTS

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:
Computer Assisted Language Learning (CALL) Lab which focusses on listening skills, Interactive Communication Skills (ICS) Lab which focusses on speaking skills

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I

CALL Lab:

Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening

Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - *Testing Exercises*

ICS Lab:

Diagnostic Test – Activity titled '*Express Your View*'

Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others

Practice: Any Ice-Breaking Activity

Exercise – II

CALL Lab:

Instruction: Listening vs. Hearing - Barriers to Listening

Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*

ICS Lab:

Instruction: Features of Good Conversation – Strategies for Effective Communication

Practice: Role Play Activity -Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III

CALL Lab:

Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)

Practice: Differences between British and American Pronunciation –*Listening Comprehension Exercises*

ICS Lab:

Instruction: Describing Objects, Situations, Places, People and Events

Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events *(A wide range of Materials / Handouts are to be made available in the lab.)*

Exercise – IV

CALL Lab:

Instruction: Techniques for *Effective* Listening

Practice: Listening for Specific Details - Listening - Gap Fill Exercises - *Listening Comprehension Exercises*

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity

Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V

CALL Lab:

Instruction: Identifying the literal and implied meaning

Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Understanding Non-Verbal Communication

Practice: Silent Speech - Dumb Charades Activity

Post-Assessment Test on 'Express Your View'

Minimum Requirement of infrastructural facilities for ELCS Lab:

Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

Computers with Suitable Configuration

High Fidelity Headphones

Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

Reference Books:

1. Shobha, KN &Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. *Five Minute Activities – A Resource Book for Language Teachers.* Cambridge University Press.

B.TECH III SEMESTER SYLLABUS

PROBABILITY, STATISTICS AND COMPLEX VARIABLES

II YEAR I SEMESTER: COMMON FOR MECHANICAL AND AERONAUTICAL ENGINEERING

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7BS04	BSC	3	0	0	3	40	60	100

COURSE OUTCOMES : After learning the contents of this paper, the student must be able to

1. Apply the concepts of Random variable and distributions to some case studies.
2. Correlate the concepts of one unit to the concepts in other units.
3. Understood sampling theory and apply hypothesis testing in real-world scenarios
4. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorem.
5. Taylor's and Laurent's series expansions in complex function

UNIT-I RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-II CONTINUOUS DISTRIBUTIONS AND SAMPLING

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. **Fundamental Sampling Distributions:** Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-III TESTS OF HYPOTHESES (LARGE AND SMALL SAMPLES)

Statistical Hypotheses: General Concepts – Procedure of Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two means. Single sample: Test on a single proportion (for Large Samples). Two samples: Tests on two proportions (for Large Samples). Two- sample tests concerning variances: F-distribution.

UNIT-IV COMPLEX DIFFERENTIATION

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V COMPLEX INTEGRATION

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.
3. R. K. Jain and S. r. k. Iyengar, Advanced Engineering Mathematics, 5th Edition, 2019.

Reference Books:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3. Murrey R. Spiegel, Seymour Lipschutz, Complex Variables, Shaum's outline series, 2nd Edition 2009.

A7ME10: MECHANICS OF SOLIDS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Engineering Mechanics

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

1. Understand and analyze stress–strain behavior of materials under various loading conditions by applying concepts of elasticity such as stress and strain and its relations for deformed bodies
2. Determine shear force and bending moment for different types of beams and loading conditions, and draw S.F. and B.M. diagrams and identifying critical feature
3. Evaluate flexural and shear stresses in beams using simple bending and shear theories to design simple beam sections based on strength criteria.
4. Analyze principal stresses and strains using analytical methods and Mohr's circle method, and apply appropriate theories of failure for safe mechanical design.
5. Design and analyze circular shafts and columns subjected to combined bending and torsion using various failure theories, and columns under axial loads using and Euler's and Rankine's Theories.

UNIT – I:

Stress and Strain: Elasticity and plasticity, Types of stresses and strains, Hooke's law, Stress – strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic moduli and the relationship between them, Bars of varying sections, Composite bars, Temperature stresses. Strain energy and Resilience: Gradual, sudden, impact and shock loadings.

UNIT – II:

Shear Force and Bending Moment: Definition of beam, Types of beams, Concept of shear force and bending moment, S.F and B.M diagrams for cantilever, Simply supported and overhanging beams subjected to point loads and Uniformly Distribute Load, Uniformly varying loads and combination of these loads, Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III:

Flexural Stresses: Theory of simple bending, Assumptions, Derivation of pure bending equation, Determination of bending stresses. Section modulus for rectangular and circular sections of Solid and Hollow: I, T, Angle and Channel sections, Design of simple beam sections.

Shear Stresses: Derivation of formula, Shear stress distribution across various beams sections: Rectangular, Circular, Triangular, I, T and Angle sections.

UNIT – IV:

Principal Stresses and Strains: Introduction, Stresses on inclined sections of a bar under axial loading, Compound stresses, Normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, Mohr's circle of stresses, Principal stresses and strains, Analytical and graphical solutions.

Theories of Failure: Introduction, Various theories of failure: Maximum Principal Stress Theory, Maximum Shear Stress Theory, Maximum Principal Strain Theory, Maximum Strain Energy Theory, Distortion Energy Theory (Von Mises Theory).

UNIT – V:

Torsion of Circular Shafts: Theory of pure torsion, Derivation of Torsion equations, Assumptions made in the theory of pure torsion, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, Combined bending and torsion and end thrust, Design of shafts according to theories of failure.

Columns and Struts: Euler's Theory, Limitations of Euler's theory, Equivalent Length, Rankine's Formula, Secant Formula.

TEXT BOOKS:

1. Strength of Materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai Publishing, 20th Edition, 2020.
2. A Text Book of Strength of Materials, Dr.R.K Bansal, Laxmi Publications, 7th Edition 2023
3. Elements of Strength of Materials, S.P. Timoshenko and D.H. Young, CBS Publishers, 5th Edition, Reprint 2020.

REFERENCE BOOKS:

1. Mechanics of Materials, Barry J. Goodno and James M. Gere, Cengage,9thEdition, 2018.
2. Strength of Materials, S. S. Rattan, Tata McGraw Hill, 2ndEdition,2011.
3. Strength of Materials, U.C. Jindal, Pearson Education India, 1st Edition, 2012.

A7ME11: MATERIAL SCIENCE AND METALLURGY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

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

1. Explain the structure-property relationships in engineering materials.
2. Interpret binary phase diagrams and understand the solidification behavior of alloys.
3. Understand heat treatment processes and their influence on mechanical properties.
4. Identify microstructures of ferrous and non-ferrous alloys.
5. Select suitable materials for mechanical applications based on their behavior and performance.

UNIT – I:
Crystal Structure: Unit cells, Metallic and Ceramic crystal structures.
Imperfection in solids: Point, line, surface and volume defects, dislocations, strengthening mechanisms, slip systems, Critical resolved shear stress.

UNIT – II:
Hume – Rothery Rules: Alloys, substitutional and interstitial solid solutions.
Phase diagrams: Interpretation of binary phase diagrams and microstructure development, Eutectic, Peritectic, Eutectiod, Peritectoid and monotectic reactions. Iron, Iron carbide phase diagrams and microstructural aspects of ledeburite, Austenite, Pearlite, Ferrite and Cementite.

UNIT –III:
Heat treatment: Isothermal transformation diagrams for FeC alloys and microstructures development: Martensite, Bainite, Annealing, Normalising, Hardening, Tempering and Spheroidising.

UNIT – IV:
Cooling Curves and Surface Hardening: Continuous cooling curves and interpretation of final microstructures and properties, Thermo mechanical treatments: Austempering, Martempering. Surface hardening methods: Case hardening, Carburizing, Nitriding, Cyaniding, Carbo Nitriding. Flame and induction hardening, Vacuum and plasma hardening.

UNIT – V:
Alloys and Composites: Alloy steels, Properties and applications of stainless steels and tool steels, Maraging steels. Types of cast irons: Grey, White, Malleable and Spheroidal Graphite cast irons. Copper and its alloys: Brass and bronze. Aluminium and its alloys: Al-Cu Alloys.
Ceramics and Composites: Types, properties and applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avner, McGraw Hill,2nd Edition, 2017
2. Material Science and Engineering, V. Raghavan, Prentice Hall of India Private Limited, 5th Edition, 2004.

REFERENCE BOOKS:

1. Mechanical Metallurgy, George E. Dieter, Tata McGraw Hill, 3rd Edition, 2013.
2. Engineering Materials, Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India Private Limited, 9th Edition, 2009.
3. Engineering Materials and Metallurgy, U. C. Jindal, Pearson, 1st Edition, 2011.

A7ME13: PRODUCTION TECHNOLOGY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Engineering Workshop

Course Outcomes: Student will be able to:

1. Understand the principles, processes, and applications of casting, welding, and metal forming techniques.
2. Select appropriate manufacturing processes (casting, welding, or forming) based on material properties and product requirements.
3. Analyze process parameters and their effects on quality, defects, and performance of manufactured components.
4. Apply knowledge of tooling, equipment, and process design in casting, welding, and metal forming operations.
5. Evaluate defects, suggest remedies, and ensure quality control in production processes.

UNIT – I:

Casting: Steps involved in making a casting, Advantage of casting and its applications, Patterns, Pattern making, Types, Materials used for patterns, Pattern allowances, Properties of moulding methods. Methods of Melting, Crucible melting and cupola operation, Defects in castings, Principles of Gating, Requirements, Types of gates, Design of gating systems, Riser, Function, Types of Riser and Riser design. Casting processes, Types, Sand moulding, Centrifugal casting, Die, Casting, Investment casting, Shell moulding.

UNIT – II:

Arc Welding: Classification, Types of welds and welded joints and their characteristics, Welding Positions, Arc welding, shielded metal arc welding, Submerged arc welding, Resistance welding, Thermit welding.

UNIT – III:

Gas Welding: Gas welding, Types, Oxyfuel gas cutting, Standard time and cost calculations. Inert Gas Welding, TIG Welding, MIG welding, Friction welding, Friction Stir Welding, Induction welding, Explosive welding, Laser Welding.

Soldering, Brazing, Heat affected zone in welding. Welding defects, Causes and remedies, Destructive and non, Destructive testing of welds.

UNIT – IV:

Hot Working and Cold Working: Strain hardening, Recovery, Recrystallization and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning, Bending and deep drawing. Rolling fundamentals, Theory of rolling, Types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types, Wire drawing and Tube drawing, Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – V:

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion, Forward extrusion and backward extrusion, Impact extrusion, Extruding equipment, Tube extrusion, Hydrostatic extrusion. Forces in extrusion.

Forging Processes: Forging operations and principles, Tools, Forging methods, Smith forging, Drop Forging, Roll forging. Forging hammers: Rotary forging, Forging defects, Cold forging, Swaging, Forces in forging operations.

High Energy Rate Forming Processes: Principles of Explosive Forming, Electrohydraulic Forming, Electro, Magnetic forming and rubber pad forming.

TEXT BOOKS:

1. A Textbook of Production Technology (Manufacturing Processes), Dr. P.C. Sharma, S. Chand Publishing, 11th Revised Edition, 2022.
2. Manufacturing Technology: Foundry, Forming and Welding, P.N. Rao, McGraw Hill Education, Vol. 1, 5th Edition, 2018.

REFERENCE BOOKS:

1. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmidt, Pearson, 7th Edition, 2014.
2. Elements of Workshop TechnologyVol.1, S.K. Hajra Choudhury, A.K. Hajra Choudhury and Nirjhar Roy, Media Publishers and Promoters Pvt. Ltd., 1st Edition,2008.
3. Production Technology: Manufacturing Processes, Technology and AutomationVol.1, R. K. Jain, Khanna Publishers, 19th Edition, 2009.

A7ME15: THERMAL ENGINEERING - I

B.Tech. II Year I Sem.
Prerequisite: Thermodynamics

L	T	P	C
3	0	0	3

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

1. Analyze air standard cycles and classify IC engines with reference to performance parameters.
2. Analyz combustion phenomena in SI engines and evaluate factors affecting combustion and knocking.
3. Analyze combustion stages in CI engines and evaluate performance influencing parameters.
4. Evaluate engine testing methods and determine performance parameters using experimental data.
5. Explain Apply thermodynamic principles to analyze the working and performance of reciprocating and dynamic compressors.

UNIT – I: Power Cycles and IC Engines Classification
Otto, Diesel and Dual Cycles, Description and representation on P-V and T-S Diagrams, Performance Parameters: Mean Effective Pressure and Thermal efficiency evaluation on Air standard basis, Comparison of Cycles, Actual Cycles and Comparison with ideal cycles Classification of IC Engines, Working principles of two and four stroke engines, SI and CI engines, Valve and Port Timing Diagrams.

UNIT – II: Combustion in SI Engines
Types of SI engines, Engine systems, Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry. Normal Combustion and abnormal combustion in SI engines, Importance of flame speed and effect of engine variables, Abnormal combustion, Pre-ignition and knocking in SI Engines, Fuel requirements and fuel rating, Anti-knock additives, Combustion chamber requirements.

UNIT – III: Combustion in CI Engines
Types of CI Engines, Four stages of combustion in CI engines, Delay period and its importance, Effect of engine variables, Diesel Knock, Need for air movement, Suction, Compression and combustion induced turbulence in Diesel engines, Open and divided combustion chambers and fuel injection, Diesel fuel requirements and fuel rating.

UNIT – IV: Testing and Performance
Parameters of performance, Measurement of cylinder pressure, Fuel consumption, Air intake, Exhaust gas composition, Brake power, Determination of frictional losses and indicated power, Performance test, Heat balance sheet and chart.

UNIT – V: Compressors
Classification of compressors, Fans, Blowers and Compressors, Positive displacement and dynamic types, Reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance volume, Staged compression, Under cooling, Saving of work, Minimum work condition for staged compression.
Rotary Compressors: Rotary Compressors (Positive displacement type): Roots Blower, Vane sealed compressor, Mechanical details and principle of working, Efficiency considerations.
Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation, Velocity and pressure variation. Energy transfer, Impeller blade shape, Losses, Slip factor, Power input factor, Pressure coefficient and adiabatic coefficient, Velocity diagrams and power.

Axial Flow Compressors: Mechanical details and principle of operation, Velocity triangles and energy transfer per stage degree of reaction, Work done factor, Isentropic Efficiency, Pressure rise calculations, Polytropic efficiency.

TEXT BOOKS:

1. I.C. Engines, V. Ganesan, Mc Graw Hill, 4th Edition, 2010.
2. Thermal Engineering, Mahesh M Rathore, Tata Mc Graw Hill, 2010

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists, Eastop and McConkey, Pearson, 5th Edition, 1993.
2. Fundamentals of Classical Thermodynamics, Vanwylen G.J and Sonntag R.E., Wiley Eastern, 2nd Edition, 1978.
3. Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill, 2nd Edition, 2018.

A7BS07: COMPUTATIONAL MATHEMATICS LAB

(Common to All Branches)

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

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

1. Develop the code to find the Eigen values and Eigen Vectors using Python.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python.
3. Write the code to solve problems of First-Order ODEs Higher order linear differential equations withconstant coefficients

UNIT – I: Eigen Values and Eigen Vectors

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT – II: Solution Of Algebraic and Transcendental Equations

Bisection method and Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.
-

UNIT – III: Linear System of Equations

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method.
- Solution of given system of linear equations using Gauss-Seidal method.

UNIT – IV: First order ODEs

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations.
- Solving exponential growth/decay and Newton's law of cooling problems.

UNIT – V: Higher Order Linear Differential Equations with Constant Coefficients

Programs:

- Solving homogeneous ODEs.
- Solving non homogeneous ODEs.

TEXT BOOKS:

1. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.
3. Introduction to Python Programming, William Mitchell, PovelSolin, Martin Novak etal.,NCLab Public Computing, 2012.
4. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

A7ME12: MECHANICS OF SOLIDS AND MATERIAL SCIENCE AND METALLURGY LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Mechanics of Solids, Material Science and Metallurgy.

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

1. Perform basic mechanical tests such as tensile etc to study the characteristic of different engineering materials.
2. Determine mechanical properties of materials through experimental methods.
3. Analyze and interpret laboratory data relating to behavior of structures and the materials
4. Analyze the microstructure of ferrous and non-ferrous metals using metallurgical microscopes and relate microstructure to material properties.
5. Conduct heat treatment processes and study their effects on material properties.

MECHANICS OF SOLIDS LAB

List of Experiments:

1. Tension test
2. Bending test
3. Torsion test
4. Brinell's hardness and Rockwell hardness test
5. Test on springs
6. Izod Impact and Charpy Impact test

MATERIAL SCIENCE AND METALLURGY LAB

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high Carbon steels.
4. Study of the Microstructures of Various Cast Irons.
5. Study of the Microstructures of Non Ferrous alloys. (Al, Cu, Mg)
6. Hardenability of steels by Jominy End Quench Test.

TEXT BOOKS:

1. Laboratory Manual in Engineering Materials, S.K. Hajra Choudhury, Asian Books Pvt. Ltd.
2. Laboratory Manual for Strength of Materials, J.P. Singh, Katson Books.

A7ME14: PRODUCTION TECHNOLOGY LAB

L	T	P	C
0	0	2	1

B.Tech. II Year I Sem.

Prerequisites: Production Technology

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

1. Design and manufacture different patterns
2. Prepare various castings.
3. Operate arc welding, gas welding and resistance welding equipment
4. Perform operations such as blanking, piercing, deep drawing, extrusion, bending and other operations.
5. Use injection molding and blow molding equipment to produce plastic products such as water bottle,caps etc.

List of Experiments:

I. Metal Casting:

1. Pattern Design and making - 1 Exercise (one casting drawing).
2. Sand properties testing - 1 Exercise (strengths, and permeability)
3. Moulding Melting and Casting -1 Exercise

II. Welding:

1. ARC Welding Lap and Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking and Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing of Plastics:

1. Injection Moulding
2. Blow Moulding

TEXT BOOK:

1. Dictionary of Mechanical Engineering, G.H.F. Nayler, Jaico Publishing House, 1st Edition, 1999.

Note: Minimum of 12 Exercises need to be performed

A7ME16: THERMAL ENGINEERING – I LAB

B.Tech. II Year, I Sem.

L	T	P	C
0	0	2	1

Prerequisite: Thermodynamics and Thermal Engineering – I

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

1. Conduct valve timing and port timing experiments to determine engine operating events.
2. Perform performance tests on two-stroke and four-stroke SI and CI engines to calculate engine performance parameters.
3. Analyze engine characteristics using Morse, retardation, motoring, and heat balance tests.
4. Evaluate the effect of air–fuel ratio and compression ratio on engine performance.
5. Disassemble and assemble engine components and explain the working principles of boilers.

List of Experiments:

I.C. Engines:

1. Valve Timing Diagram.
2. Port Timing Diagram.
3. Performance Test for 4 Stroke SI engines.
4. Performance Test for 2 Stroke SI engines.
5. Morse Test.
6. Heat Balance – CI Engine.
7. Effect of Air Fuel Ratio in a SI engine.
8. Effect of Air Fuel Ratio in a CI engine.
9. Performance Test on a 4 Stroke CI Engine at constant speed.
10. Performance Test on Variable Compression Ratio Engine.

Other Experiments:

1. Disassembly, Assembly of Engines.
2. Retardation Test on a 4 Stroke CI Engine.

Note: Perform a minimum of any 10 out of the 12 Exercises.

LAB MANUALS:

1. Internal Combustion Engines Laboratory Manual, Dr. K. Sudhakar and Dr. S. Ramasamy, VSRD Academic Publishing, 2021.
2. Thermal Engineering Lab Manual, Er. R.K. Rajput and Er. R.S. Khurmi, S. Chand Publications, 2022.

A7ME17: DESIGN THINKING AND IDEATION

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

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

1. Understand the principles and stages of the design thinking process.
2. Apply empathy and user research tools to understand user needs.
3. Use ideation techniques like brainstorming and mind mapping to generate solutions.
4. Develop and refine prototypes through iterative testing.
5. Present solutions using storytelling and plan for implementation.
6. Collaborate on real, world challenges using end to end design thinking.

UNIT – I:

Fundamentals of Design Thinking: Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, the need of design thinking; An approach to design thinking, Design thinking Process model, Design thinking tools.

Case Studies: General, Engineering and Service applications

Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and prepare a design brief.

UNIT – II:

Empathize and Understanding User Needs: Design thinking phases, how to empathize, Role of empathy in design thinking, the purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas.

Define: Methods of Define Phase: Storytelling, Critical items diagrams, Define success

Activities: Apply the methods of empathizing and Define Phases Finalize the problem Statement (User Interview practice, empathy mapping, shadowing or observation study).

UNIT – III:

Ideation and Generating Solutions: Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method, Create Thinking, Generating Design Ideas, Lateral Thinking, Analogies, Brain storming, Mind mapping, National Group Technique, Synectic's, Development of work, Analytical Thinking, Group Activities.

Ideation Tools: How Might We? (HMW), Storyboard, Brainstorming. What is design innovation? A mindset for innovation, and asking "What if?" asking "What wows?" and "What works?"

Activities: Apply the methods of Ideate Phase: Generate Lots of Ideas (Brain Storming Sessions, SCAMPER Technique Activity and Rapid Sketching.

UNIT – IV:

Prototyping and Building the Solution: What is a prototype? Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping, Minimum Viable prototype.

Activities: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas (Paper prototyping, digital prototyping and story board creation).

UNIT – V:

Testing Prototypes and Validation: Prototyping for digital products: What's unique for digital products,

Preparation: Prototyping for physical products: What's unique for physical products, Preparation;

Testing prototypes with users. Create a Pitch Plan for scaling up Road map for Implementation, Fine tuning

and Submission of the project report

Activities: Collect feedback; iterate and improve the ideas Present your solution using the Storytelling method (Usability testing, Feedback Grid Exercise and Iteration Activity)

Capstone Activity:

Mini Design Challenge: Apply all stages of design thinking on a real-world problem provided by industry/community.

TEXT BOOKS:

1. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, HarperCollins Publishers Ltd., 2009.
2. Design Thinking for Strategic Innovation, Idris Mootee, John Wiley and Sons Inc., 2013...

TOOLS AND TECHNIQUES USED:

Sticky Notes, Whiteboards, Canva, Figma, TinkerCAD, Mind Mapping tools, Sketching Kits, Empathy Maps, Journey Maps and related softwares.

B.TECH IV SEMESTER SYLLABUS

A7HS06: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

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

1. Gain the conceptual knowledge on Business Economics and practical applications of Demand and Supply viz. Laws, Types, Elasticity, and Forecasting and Equilibrium.
2. Familiarize the concepts and applications related to Production and Cost of a firm.
3. Assess the features of different Market Structures and forms of Business Organizations existing in the modern business.
4. Analyze how Capital Budgeting decisions are carried out.
5. Elaborate the concepts and principles of Financial Accounting & interpret financial statements through ratio analysis.

UNIT – I: INTRODUCTION TO BUSINESS ECONOMICS & DEMAND AND SUPPLY ANALYSIS

Business Economics: Definition, Nature and Scope of Business Economics.

Demand Analysis: Demand Determinants, Law of Demand and its exceptions, Elasticity of Demand, Types, Measurement and its Significance, Demand Forecasting and its Methods.

Supply Analysis: Law of Supply, Supply Function, Equilibrium of Demand and Supply.

UNIT – II: PRODUCTION & COST ANALYSIS

Production Function – Law of Variable Proportions and Laws of Returns to Scale, Isoquants and Isocosts, MRTS, Cobb-Douglas Production function, Economies of Scale.

Cost Analysis: Cost concepts, Break-even Analysis (BEA).

UNIT – III: MARKET STRUCTURE, PRICING & BUSINESS ORGANISATIONS

Market Structure: Classification of market structures, Features of Perfect competition, Monopoly, Oligopoly and Monopolistic Competition. Pricing: Objectives and Policies, and Methods.

Business Organisations: Features and evaluation of different forms of Business Organisations- Sole Proprietorship, Partnership, Joint Stock Company, Government, Private and Cooperative.

UNIT – IV: CAPITAL BUDGETING

Capital and its significance: Types of Capital, Methods and sources of raising capital.

Capital Budgeting: Features of capital budgeting proposals

Methods of Capital Budgeting: Payback Period- Accounting Rate of Return- Net Present Value- Internal Rate of Return and Profitability Index (simple problems).

UNIT – V: INTRODUCTION TO FINANCIAL ACCOUNTING & ANALYSIS

Financial Accounting: Accounting concepts and Conventions - Double - Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts with simple adjustments.

Financial Analysis: Analysis and Interpretation of Financial Statements, Financial Analysis through Liquidity, Leverage, Solvency and Profitability ratios.

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Prasanna Chandra, Financial Management, 10th Edition, Mc Graw Hill, 2019.
3. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.

REFERENCE BOOKS:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. P S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013.
3. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5th Edition, Vikas Publications, 2013.
4. I. M. Pandey, Financial Management, 11th Edition, Vikas Publications, 2015.

A7HS08: INNOVATION AND ENTREPRENEURSHIP

B.Tech. II Year II Sem.

L	T	P	C
2	0	0	2

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

1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.
3. Assess market competition, estimate market size, and develop a prototype.
4. Aalyze Business and financial planning models and Go-to-Market strategies.
5. Build a start-up, register IP and identify funding opportunities.

UNIT – I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship,

Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity..

UNIT – II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model.

Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER,

Design thinking principles, Mapping of solution to problem.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

UNIT – III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

UNIT – IV: Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT – V: Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.

Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Readings:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Stratup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6. NISP -Brochure inside pages - startup_policy_2019.pdf

A7ME20: KINEMATICS OF MACHINERY

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Basic principles of Mechanics

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

1. Apply the principles of kinematic pairs, and chains, along with analyzing mechanisms their inversions to develop or build a machine to perform particular task
2. Draw vectors polygons and estimate the velocity and acceleration using relative velocity, instantaneous center methods for various simple mechanisms
3. Analyze the lower pairs and its conditions to execute such as straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
4. Design and develop the cam profiles for various follower motion configurations, and evaluate the displacement, velocity, and acceleration of the follower.
5. Analyze toothed gears and gear trains, including tooth profiles and operating conditions, used in mechanical power transmission systems.

UNIT – I:

Mechanisms: Elements or Links, Classification, Rigid Link, Flexible and Fluid link, Types of kinematics pairs, Sliding, Turning, Rolling, Screw and spherical pairs, Lower and Higher pairs, Closed and open pairs, Constrained motion, Completely, Partially or successfully and incompletely constrained.

Mechanism and Machines: Mobility of Mechanisms: Grubler's criterion, classification of machines, Kinematics chain, Inversions of mechanism, Inversions of quadric cycle chain, Single and double slider crank chains, Mechanical Advantage.

UNIT – II:

Kinematics: Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration, Graphical method, Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation, Centrodes and Axodes, Three centers in line theorem, Graphical determination of instantaneous center, Determination of angular velocity of points and links by instantaneous center method.

Acceleration of Mechanisms: Analysis of slider crank chain for displacement, Velocity and Acceleration of slider, Acceleration diagram for a given mechanism. Kliens construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

UNIT – III:

Straight Line Motion Mechanisms: Exact and approximate copied and generated types, Peaucellier, Hart, Scott Russel, Grasshopper, Watt, Tchebicheff's and Robert Mechanism, Pantographs.

Steering Gears: Conditions for correct steering, Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint, Velocity ratio, Application, Problems.

UNIT – IV:

Cams and Followers: Definitions of cam and followers and their uses, Types of followers and cams, Terminology, Types of follower motions, Uniform velocity, Simple harmonic motion, Uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes.

UNIT – V:

Gears and Gear Trains: Friction wheels and toothed gears, Types, Law of gearing, Condition for constant velocity ratio for transmission of motion, Velocity of sliding. Forms of teeth, Cycloidal and involutes profiles, Phenomena of interferences, Methods of interference. Condition for minimum number of teeth to avoid interference, Expressions for arc of contact and path of contact of Pinion, Gear, Pinion and Rack Arrangements, Introduction to Helical, Bevel and worm gearing.

Introduction to Gear Trains, Types, Simple, Compound and reverted gear trains, Epicyclic gear trains. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box, Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines and Mechanisms, Uicker, J.J., Pennock G.R and Shigley, Oxford University Press, 4th Edition, 2014.
2. A Textbook of Theory of Machines, R. K. Bansal and J. S. Brar, Laxmi Publications, 5th Revised Edition, 2010.

REFERENCE BOOKS:

1. Theory of Machines, Thomas Bevan, CBS Publishers and Distributors, 3rd Edition,2005..
2. Theory of Machines, Sadhu Sigh, Pearson Education, 3rd Edition, 2012.
3. Kinematics and Dynamics of Machinery, Robert L. Norton, Tata McGraw Hill, 2009.
4. Theory of Machines, S.S. Rattan, Tata McGraw Hill, 4th Edition, 2014.

A7ME21: DESIGN OF MACHINE ELEMENTS

B.Tech. II Year, II Sem.

L	T	P	C
3	0	0	3

Note: Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

Prerequisites: Engineering Mechanics, Mechanics of Solids.

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

1. Apply stress–strain relationships to compute simple, combined, torsional, bending, and impact stresses.
2. Analyze components subjected to variable stresses using Goodman, Gerber, and Soderberg criteria..
3. Analyze various modes of failure and efficiency of riveted, fillet welded, and pre-stressed bolted joints.
4. Compare different types of joints based on strength, rigidity and application requirements.
5. Apply strength and rigidity criteria to design solid and hollow shafts subjected to bending, torsion, and axial loads.

UNIT – I: Introduction

General considerations in the design of Engineering Materials and their properties, Selection, Manufacturing consideration in design. Tolerances and fits, BIS codes of steels.

Design for Static Strength: Simple stresses, Combined stresses, Torsional and Bending stresses, Impact stresses, Stress - strain relationship, Theories of failure, Factor of safety, Design for strength and rigidity, Preferred numbers. The concept of stiffness in tension, Bending, Torsion and combined situations.

UNIT – II: Design for Fatigue Strength

Stress concentration, Theoretical stress Concentration factor–Fatigue stress concentration factor, Notch Sensitivity, Design for fluctuating stresses, Endurance limit, Estimation of Endurance strength, Gerber's curve, Goodman's line, Soderberg's line.

UNIT – III: Riveted, Welded and Bolted Joints

Riveted joints: Methods of failure of riveted joints, Strength equations, Efficiency of riveted joints, Eccentrically loaded riveted joints.

Welded Joints: Design of fillet welds, axial loads, Circular fillet welds under bending, Torsion. Welded joints under eccentric loading.

Bolted joints: Design of bolts with pre-stresses, Design of joints under eccentric loading – locking devices, bolts of uniform strength.

UNIT – IV: Keys, Cotters and Knuckle Joints

Design of keys, Stresses in keys, Cotter joints, Spigot and Socket, Sleeve and Cotter, Gib and Cotter joints, Knuckle joints.

UNIT – V: Shafts and Couplings

Design of solid and hollow shafts for strength and rigidity, Design of shafts for combined bending and axial loads, Shaft sizes, BIS code. Gaskets and seals (stationary and rotary).

Rigid couplings: Muff, Split muff and Flange couplings. Flexible couplings: Flange coupling (Modified).

TEXT BOOKS:

1. Mechanical Engineering Design, Joseph Edward Shigley, McGraw Hill, 10th Edition, 2022.
2. Design of Machine Elements, V.B. Bhandari, McGraw-Hill, 5th Edition, 2010

REFERENCE BOOKS:

1. Theory of Machines, Dr. N.C. Pandya and Dr. C.S. Shah, Charotar Publishing House Pvt. Ltd., 21st Edition, 2022.
2. Design of Machine Elements – I, Anup Goel, Technical Publications, 2020.
3. Machine Design, Jindal, Pearson, 1st Edition, 2010.

A7ME22: FLUID MECHANICS AND HYDRAULIC MACHINES

L	T	P	C
3	0	0	3

B.Tech. II Year II Sem.

Prerequisites: Engineering Mechanics, Thermodynamics

Course Outcomes:

1. Determine fluid properties, calculate pressure at a point, and analyze hydrostatic forces on immersed surfaces.
2. Apply the continuity equation, Euler's equation, and Bernoulli's equation to analyze flow behavior, along with momentum principles.
3. Determine pipe friction losses, minor losses, and analyze flow through pipelines and network systems.
4. Classify and evaluate the performance of hydraulic turbines (e.g., Pelton, Francis, Kaplan) based on efficiency, speed, and cavitation.
5. Analyze the working principles and performance characteristics of centrifugal and reciprocating pumps

UNIT – I: Fluid statics

Dimensions and units: Physical properties of fluids, Specific gravity, Viscosity and surface tension, Vapour pressure and their influence on fluid motion, Atmospheric, Gauge and vacuum pressures, Measurement of pressure, Piezometer, U-tube and differential manometers.

UNIT – II: Fluid kinematics

Stream line, Path line and streak lines and stream tube. Classification of flows: Steady and unsteady, Uniform and non, Uniform, Laminar and turbulent, Rotational and irrotational flows, Equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line, Momentum equation and its application on force on pipe bend.

UNIT – III: Boundary Layer Concepts

Definition, Thicknesses, Characteristics along thin plate, Laminar and Turbulent boundary layers (No derivation), Boundary layer in transition, Separation of boundary layer, Submerged objects, Drag and lift.

Closed conduit flow: Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes, Pipes in series and pipes in parallel, Total energy line, Hydraulic gradient line.

Measurement of flow: Pitot tube, Venturi meter and Orifice meter, Flow nozzle.

UNIT – IV: Basics of Turbo Machinery

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity diagrams, Work done and efficiency, Flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, Impulse and Reaction Turbines, Pelton wheel, Francis turbine and Kaplan turbine, Working proportions, Work done, efficiencies, Hydraulic Design, Draft tube theory, Functions and efficiency.

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, Characteristic curves, Governing of turbines, Selection of type of turbine, Cavitation, Surge tank, Water hammer.

UNIT – V: Centrifugal Pumps and Reciprocating Pumps:

Centrifugal Pumps: Classification, Working, Work done, Barometric head, Losses and efficiencies, Specific speed, Performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, Slip, Indicator diagrams.

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery, Modi and Seth, standard Book House, 22nd Edition, 2019.
2. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition, 2020.

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines, Er. R. K. Rajput, S. Chand, 2019.
2. Hydraulic Machines: Fluid Machinery, Jagdish Lal, Metropolitan Book Co., 6th Edition, 2016.
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria and Sons, 22nd Edition, 2018.
4. Hydraulic Machines, T.R. Banga and S.C. Sharma, Khanna Publishers, 7th Edition, Rpt. 2019.

A7ME24: METROLOGY AND MACHINE TOOLS

B.Tech. II Year II Sem.

L	T	P	C
2	0	0	2

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

1. Apply the measurement principles and perform linear and angular measurements using precision instruments to ensure dimensional accuracy and interchangeability
2. Evaluate the parameters of surface finish, screw threads, gears, machine tool alignment, and coordinate measurements to enhance the quality control.
3. Explain the fundamentals of metal cutting mechanics, tool geometry, cutting forces, chip formation, and the working of various lathe machines..
4. Apply the principle operations of drilling, boring, shaping, slotting, and planing machines to select appropriate machining processes and machining time.
5. Select suitable machining method and machining time by applying the principles of milling, grinding, lapping, honing, and broaching process.

UNIT – I: Linear and Angular Measurements

Limits, fits and tolerances - Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Limit Gauges: Taylor's principle, Design of GO and NO GO gauges Measurement of angles, Bevel protractor, and Sine bar. Measurements by using auto collimator.

UNIT – II: Surface Roughness Measurement

Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines. Coordinate Measuring Machines: Types and Applications of CMM.

UNIT – III: Metal Cutting & Lathe Machines

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Merchants Circle Diagram and cutting forces, Chip formation and types of chips. Engine lathe – Principle of working, types of lathes, specifications. Taper turning, – Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes.

UNIT – IV: Drilling and Boring Machines

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines Principles of working – machining time calculations; Work Holding Devices-Jigs and Fixtures, Types and applications.

UNIT – V: Milling & Grinding Machines

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing. Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

TEXT BOOKS:

1. Machine Tool Practices/ Kibbe, Johne. Neely, T. White, Rolando O. Meyer/ Pearson
2. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / McGraw Hill.
3. A Text Book of Metrology/M.Mahajan/Danpat Rai

REFERENCE BOOKS:

1. Principles of Machine Tools, Bhattacharyya A and Sen. G.C / New Central Book Agency.
2. Fundamentals of Dimensional Metrology / Connie Dotson / Thomson
3. Metrology & Measurements – Bewoor & Anand Kapoor

A7ME23: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Outcomes:

1. Develop procedure for standardization of experiments.
2. Calibrate flow discharge measuring devices used in pipes.
3. Determine the major and minor losses in a given pipe.
4. Prove that the total head at any point along the fluid flow is same.
5. Test the performance of pumps and turbines.

List of Experiments:

Fluid Mechanics:

1. Venturimeter.
2. Orifice meter.
3. Friction factor for a given pipe line.
4. Loss of head due to sudden contraction in a pipeline.
5. Application of Bernoulli's Theorem.

Hydraulic Machinery: Performance Test on

1. Impact of jets on Vanes.
2. Pelton Wheel.
3. Francis Turbine.
4. Kaplan Turbine.
5. Single Stage Centrifugal Pump.
6. Multi Stage Centrifugal Pump.
7. Reciprocating Pump.

LAB MANUALS:

1. Fluid Mechanics and Machinery Laboratory Manual, Sadhu Singh, Khanna Publishers, 2022.
2. Fluid Mechanics and Hydraulic Machines, K. Subramanya, McGraw Hill Education, 2022.

A7ME25: METROLOGY AND MACHINE TOOLS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Course Overview:

This course intends to understand the concepts of metrology and machine tools and to get practical exposure to the metrology equipment & Machine tools.

Course Outcomes:

At the end of the course, students are able to:

1. Apply precision measuring instruments such as Vernier Calipers, Vernier height gauge, Micrometer and gear tooth Vernier to measure linear dimensions.
2. Examine angles, tapers, and threads of mechanical components using bevel protractor, sine bar, two-wire/three-wire method, and tool maker's microscope.
3. Practice operations such as step turning, taper turning, knurling, thread cutting, boring, drilling, and tapping using lathe and drilling machines.
4. Apply shaping, planing, slotting, and milling operations to machine flat, angular, and contoured surfaces as per given specifications.
5. Practice cylindrical, surface and tool angle grinding operations to achieve accurate dimensions, required surface finish, and correct tool geometry.

List of Experiments:

Metrology:

1.Measurement of length, height, diameter by vernier callipers and vernier height guage.
2. Use of gear tooth vernier callipers and checking the chordal thickness of spur gear.
3. Angle and taper measurements by bevel protractor, Sine bars, etc.
4. Thread measurement by two wire/ three wire method & tool makers microscope.
5. Measurement of length, diameter, depth and bore diameter by using micrometer (inside and outside) and dial bore indicator.

Machine Tools:

1. Step turning, taper turning and Knurling operations on lathe machine
2. Thread cutting and Boring operations on lathe machine.
3. Drilling and tapping by drilling Machine
4. Shaping and planning
5. Slotting and Milling operations
6. Cylindrical and Surface grinding
7. Grinding of tool angles.

A7ME26: COMPUTER AIDED MACHINE DRAWING LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Computer Aided Engineering Drawing

Course Outcomes:

1. Draw the basic proportionate drawings for screws, keys and joints.
2. Construct2D drawings of various components such as couplings and bearings.
3. Combine parts to form an assembly of mechanical components such as stuffing box, screw jack and connecting rod

List of Experiments:

Drawing of Machine Elements and Simple parts:

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Screw threads, nuts and bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Revited joints.
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Assembly Drawings:

Drawing of assembled views for the part drawing of the following using conventions and easy drawing proportions.

1. Steam engine parts, Stuffing box, Cross head, Eccentric.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts: Screw jack, Connecting rod, Plumber block, Fuel Injector.
4. Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE:

1. First angle projection to be adopted.
2. All the drawing components, Assembly to be drawn using any Computer aided drafting packages.

TEXT BOOKS:

1. Machine Drawing, N.D.Bhatt, Charotar Publication, 51st Edition, 2022.
2. Machine Drawing with Auto CAD, Goutham Pohit and Goutam Ghosh, Pearson, 2016.

REFERENCE BOOKS:

1. Machine Drawing, Bhattacharyya, Oxford, 2011.
2. Machine Drawing, Ajeet Singh, Mc Graw Hill, 2nd Edition, 2012.

A7DS30: DATA ANALYTICS AND PYTHON FOR ENGINEERS

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

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

1. Write Python programs for engineering computations and data processing.
2. Clean and transform data using Pandas.
3. Create visualizations using Matplotlib and Seaborn.
4. Perform descriptive and predictive statistical analyses.
5. Analyze engineering datasets for performance insights and Apply analytics to realworld problems like predictive maintenance.

UNIT – I: Python Fundamentals for Engineering Applications

Basic Python Programming: Writing simple Python scripts for arithmetic, loops, and functions.

Application: Calculate mechanical or electrical parameters (e.g., stress, power, resistance).

Data Types and Structures: Practice using lists, dictionaries, tuples, sets. Application: Storing sensor data, part specifications, material properties.

File Handling in Python: Read/write data from .txt, .csv files. Application: Reading experimental or log data from machines.

UNIT – II: Data Handling and Processing

Data Import and Cleaning using Pandas: Load data from Excel/CSV, handle missing data, remove outliers. **Application:** Clean experimental datasets from lab instruments.

Data Transformation and Aggregation: Grouping, filtering, and summarizing data.

Application: Analyze machine run times, failure logs, or production efficiency.

Data Visualization with Matplotlib and Seaborn: Line plots, bar charts, histograms, box lots.

Application: Visualize stress, strain graphs, sensor trends, or energy consumption.

UNIT – III: Statistical Analysis and Engineering Insights

Descriptive Statistics: Mean, median, mode, standard deviation, variance.

Application: Analyze tolerance distribution, process variations.

Correlation and Regression Analysis: Perform and interpret linear regression.

Application: Predict thermal efficiency, or material behavior with respect to time/temp.

Hypothesis Testing: Perform t- tests and ANOVA. Application: Test impact of material changes on performance metrics.

UNIT – IV: Applied Data Analytics

Sensor Data Analysis: Analyze timeseries data from IoT or sensor logs.

Application: Predict motor failure or anomalies in temperature/humidity.

Real-time Data Dashboard (Optional with Jupyter/Streamlit): Build a basic data dashboard using Python tools.

Application: Monitor lab machine metrics or simulate process control.

UNIT – V: Mini Projects / Case Studies

Engineering Case Study – Predictive Maintenance: Analyze historical machine data to predict failure using regression/classification.

Energy Audit Data Analytics: Load and analyze power consumption data from equipment.

Optimization using Python (SciPy): Solve basic optimization problems (e.g., minimize cost, material use).

Text Books:

1. Python for Data Analysis, Wes McKinney, O'Reilly Media, 3rd Edition,2022.
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, Green Tea Press / O'Reilly Media, 2nd Edition, 2015.
3. Python Programming: An Introduction to Computer Science, John M. Zelle and Franklin,Beedle and Associates Inc.,3rd Edition,2016.
4. Data Analytics: Made Accessible, Anil Maheshwari, Amazon Digital Services / CreateSpace Independent Publishing, 1st Edition, 2014.

Tools and Library to be Use: Python, Jupyter Notebook, Pandas, NumPy, Matplotlib, Seaborn, SciPy, Scikit- learn (introductory).

A7HS05: INDIAN KNOWLEDGE SYSTEM

B.Tech. II Year II Sem.

L	T	P	C
1	0	0	1

Bharat is considered one of the oldest civilizations of the world. Some of the archaeological evidences proved the existence of Indus Valley Civilization in 7000 B.C. Bhartiya traditions, culture, cultural activities, rituals, sacraments, painting, art of dancing, art of singing etc. is being practiced till the modern times without knowing scientific approaches behind that. Eternity of Indian knowledge system proved itself that not only many rituals but also many traditions, many streams of knowledge like astrology, mathematics, physics, chemistry, biology, language studies, yoga and meditation had been following from the starting till now with some changes, in the form of traditions.

This course is for undergraduate students to inculcate Indian values. It will promote advance study and inter disciplinary research on all aspects of the Indian knowledge system.

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

1. Understand nature, scope and related fields of Indian knowledge system.
2. Demonstrate the scientific literature available in ancient Indian traditions
3. Understanding the application of Bharatiya Jnana Parampara
4. Understand Indian approach towards Wellbeing
5. Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

UNIT – I: Introduction to Indian Knowledge Systems

Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition.

UNIT – II: Overview of History of Indian Education and Scientific Literature

Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature - Vedic Literature - Available Scientific Treatises – Interlinkings.

UNIT – III: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems

Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinkings and applications.

UNIT – IV: Introduction to Ancient Indian Wellness Systems

Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics.

UNIT – V: Development of Engineering, Science, Technology & Fine Arts in India

Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temple Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts

- **Pedagogy for Teachers: Apart from Class Room Instruction, the following Methods are Suggested.**

1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

Suggested Readings:

1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) 'Introduction to Indian Knowledge Systems: Concepts and Applications' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) 'Indian Science and Technology in the Eighteenth Century'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) 'Indian Knowledge Systems' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369
4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

Video Resources:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

Websites:

- https://iksin dia.org/index.php
- Official Website of IKS- Indian Knowledge System
- https://www.youtube.com/watch?v=uKcf-hSlcUE
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- https://www.youtube.com/watch?v=MDJTXNiH2_A
- Mukul Kanitkar on Bharatiya Knowledge System
- https://www.youtube.com/watch?v=uARMhv97pjk
- https://www.youtube.com/watch?v=oTwgf56GbsA
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW
- Ancient India's Scientific Achievements& Contribution in Mathematics, Astronomy, Science & Medicine

Programs Outcomes (POs)

PO1. Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3. Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5

PO4. Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5. Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6. The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7. Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8. Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9. Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10. Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments

PO11. Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

PSO1: To solve complex mechanical engineering problems which enables students employable in reputed industries or self-entrepreneurs.

PSO2: To develop the new products/systems in collaboration with research & development centers and to continue higher education.

INSTITUTE VISION STATEMENT

Promote academic excellence, research, Innovation, and entrepreneurial skills to produce graduates with human values and leadership qualities to serve the nation.

INSTITUTE MISSION STATEMENTS

Provide student-centric education and training on cutting-edge technologies to make the students globally competitive and socially responsible citizens.

Create an environment to strengthen the research, innovation and entrepreneurship to solve societal problems.

QUALITY POLICY

We, at MLRIT, are committed to Educate, Enrich and Excel, in imparting Professional Education, by top-quality faculty; who endeavor to mentor the stuents as turn-key solution providers, while striving continually to improve through team work, innovation and research.

GOALS OF MLRIT

Goals of Engineering education at undergraduate / graduate level:

- Equip students with industry – accepted career and life skills
- To create a knowledge warehouse for students
- To disseminate information on skills and competencies that are in use and in demand by the industry.
- To create learning environment where the campus culture acts as a catalyst to student fraternity to understand their core competencies, enhance their competencies and improve their career prospects.
- To provide base for lifelong learning and professional development in support of evolving career objectives, which include being informed, effective, and responsible participants within the engineering profession and in society.
- To prepare students for graduate study in Engineering and Technology.
- To prepare graduates to engineering practice by learining from professional engineering assignments.