SITS – R25
ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(I & II Year Syllabus)

MECHANICAL ENGINEERING

For

B.TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2025-2026)

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES

(UGC – AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by *NBA,NAAC with 'A+' Grade, *nirf Ranked Institution

Narapally, Korremula Road, Ghatkesar, Medchal-Malkajgiri (Dist) - 500 088

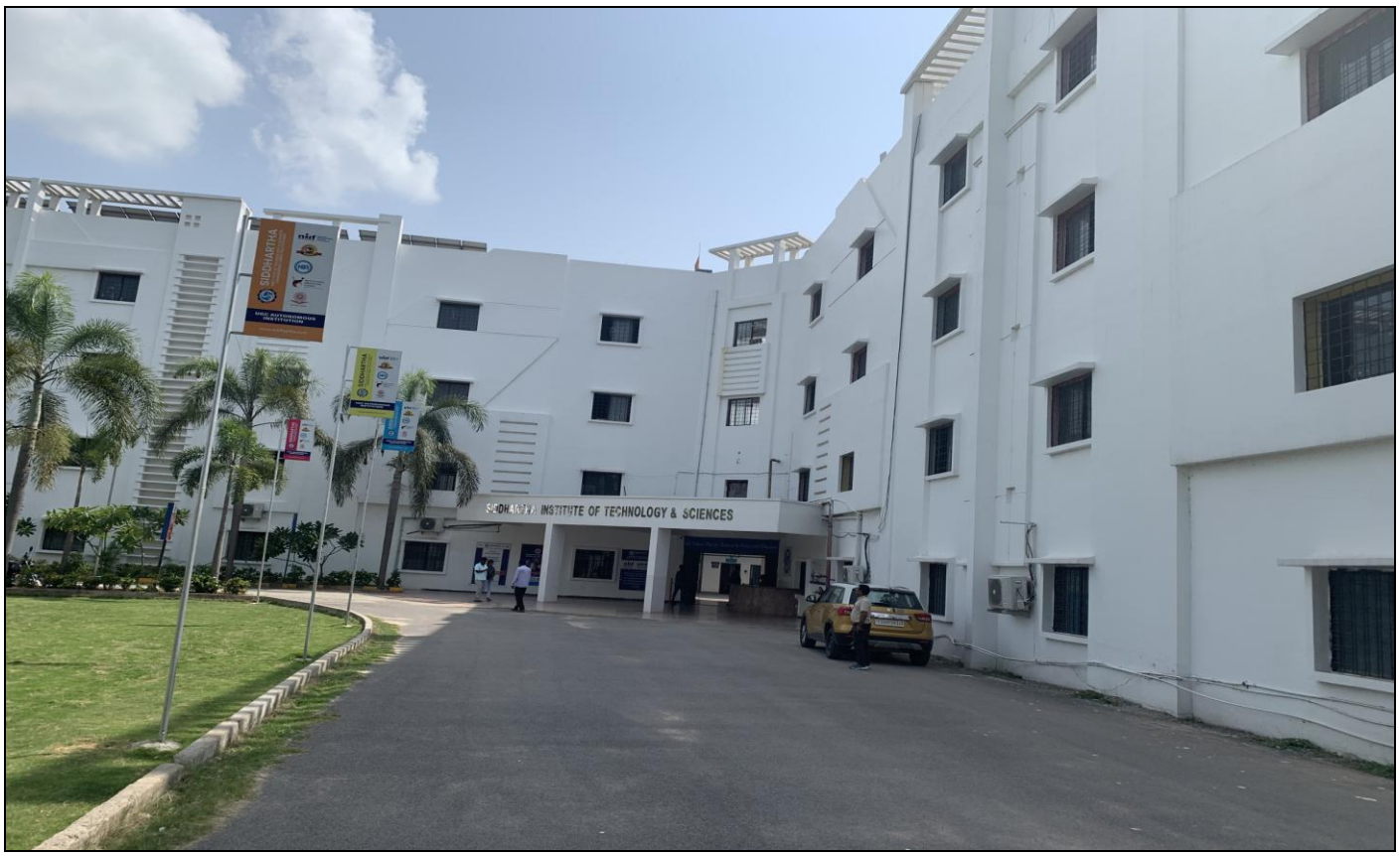
Established: 2008 **EAMCET Code: SISG**

Academic Regulations, Course Structure and Detailed Syllabus under Autonomous Status

Bachelor of Technology (B.Tech)

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

SITS – R25 Regulations



www.siddhartha.co.in e-mail: principal@siddhartha.co.in

PRELIMINARY DEFINITIONS AND NOMENCLATURES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Dropping from Semester: Student who doesn‘t want to register for any semester can apply in writing in prescribed format before the commencement of that semester.

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

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

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

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

Honors: An Honors degree typically refers to a higher level of academic achievement at an undergraduate level.

Institute: Means Siddhartha Institute of Technology & Sciences, Hyderabad unless indicated otherwise by the context.

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

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

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before

student register another course at the next grade level.

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

Programme: Means, UG degree Programme: Bachelor of Technology (B.Tech); PG degree Programme: Master of Technology (M. Tech).

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

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

Re-Appearing: A student can reappear only in the semester end examination for theory component of a course, subject to the regulations contained herein.

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

Regulations: The regulations, common to all B.Tech Programmes offered by Institute, are designated as - SITS - R25 Regulations and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

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

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

University: Means Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of odd or even semester (deadlines are different for summer sessions). However, he / she can choose a substitute course in place of it, by exercising the option within 5 working days from the date of withdrawal.

FOREWORD

The autonomy is conferred to Siddhartha Institute of Technology & Sciences (SITS), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies including J N T University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf. Thus, an autonomous institution is given the freedom to have its own **examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

SITS is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies such as Academic Council and Board of Studies (BOS) are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure, and syllabi under autonomous status.

The autonomous regulations, course structure, and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute in order to produce a quality engineering graduate to the society.

All the faculty, parents, and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

PRINCIPAL

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ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS

WITH EFFECT FROM THE ACADEMIC YEAR 2025-26 (SITS - R25)

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

Siddhartha Institute of Technology & Sciences (UGC-Autonomous) offers new regulations termed as SITS R25 regulations for four-year (eight semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous affiliated colleges, with effect from the academic year **2025-26.**

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 University or on the basis of any other order of merit approved by the University, 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-termandsemester-endexams.Around15instructionhours,30instructionhoursand45hours of learning need to be followed per one credit of theory course, practical course and project/field-basedlearningrespectively.Ineachsemester,thereshallbe'ContinuousInternal 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 University.

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 University 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 60marks 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 university 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 student's registrations is 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 up to 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 100marks 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 for10 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 5marks 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 Principals shall schedule these sessions in their semester plan.

9.2.2 Engineering Drawing and Computer Aided Drafting Course:

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 first mid-term exam will be conducted in the conventional mode using a drawing board**,** while the second mid-term exam will be conducted using a CAD package**.**

9.3 A **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 University.

9.4 Semester End Examination for theory courses

9.4.1 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.

9.4.2 Engineering Drawing and Computer Aided Drafting 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.

9.4.3 Duration of SEE:
The duration of Semester End Examination of theory and drawing courses is 3hours.

9.5 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 college.

In the Semester End Examination for practical courses held for 3 hours, rubrics of evaluation for 60 marks are 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. 10marksforviva-voceonconcernedlaboratorycourse.

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.

9.6 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.

9.7 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.

9.7.1 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.

9.8 UG Project Work:

9.8.1 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.

9.8.2 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.

9.8.3 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

9.8.4 The External Evaluation shall be conducted by the external examiner for a total of 60marks.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.

9.8.5 For conducting viva-voce exam of project work, University appoints an external examiner. The external examiner may be selected from the list of experts submitted by the Principal of the College.

9.8.6 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.

9.9 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.

9.10 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 University 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 lessthan90	A^+ (Excellent)	9
70 and lessthan80	A (Very Good)	8
60 andlessthan70	B^+ (Good)	7
50 and lessthan60	B (Average)	6
40 and lessthan50	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

$$\mathrm{SGPA} = \left\{ \sum_{i=1}^{N} C_i G_i \Big/ \sum_{i=1}^{N} C_i \right\}$$

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 than160 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 ratios 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 corresponds 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

$$\text{CGPA} = \left\{ \sum_{ij=1}^{M} C_j G_j / \sum_{j=1}^{M} C_j \right\}$$

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 in to 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
Course1	4	A	8	4x8=32
Course2	3	O	10	3 x10=30
Course3	3	C	5	3 x5=15
Course4	3	B	6	3x6=18
Course5	3	A	8	3x8=24
Course6	2	A+	9	2x9=18
Course7	1	C	5	1 x5=5
Course8	1	O	10	1 x10=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 University 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 maybe 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 fulfillment of attendance requirement.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester and fulfillment 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 fulfillment of attendance requirement.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfillment 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 fulfillment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester And fulfillment 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 SITS-R25Academic 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 in to equivalent Percentage of Marks

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.

University shall undertake the responsibility of assessing the infrastructure requirements necessary to support Minor Degree programs as well as Honours degree programs during the fact-finding committee (FFC) visits to the affiliated colleges. During FFC visits, JNTUH team will physically verify the facilities available for offering the proposed Minors and Honours courses along with other regular verifications. Only the University approved Minors and Honors shall be offered at the respective affiliated colleges.

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 fulfill 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 University-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 University'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 that particular college, then student should consult the University 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 class work.

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 University 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 SITS-R25Regulations:

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 SITS-R25regulations are in force.

22.2 A student detained due to shortage of attendance and re-admitted in SITS-R25 regulations: Such students shall be permitted to join the same semester, but in SITS-R25 Regulations.

22.3 A student detained due to shortage of credits and re-admitted in SITS-R25 regulations: Such students shall be promoted to the next semester in SITS-R25 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 SITS-R25 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 SITS-R22 regulations by the University. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

22.6 Look Up Table of equivalence courses

22.6.1 A look up table will be provided for the benefit of students and Principals. This lookup table will include all the courses to be registered by students who have been re-admitted under the SITS-R25 Academic Regulations from the SITS-R22 Academic Regulations. Separate lookup tables will be provided for the following categories of students:

1. Students re-admitted into the I Year II Semester of the SITS-R25 Regulations
2. Students re-admitted into the II Year I Semester of the SITS-R25 Regulations
3. Students re-admitted into the II Year II Semester of the SITS-R25 Regulations
4. Students re-admitted into the III Year I Semester of the SITS-R25 Regulations
5. Students re-admitted into the III Year II Semester of the SITS-R25 Regulations
6. Students re-admitted into the IV Year I Semester of the SITS-R25 Regulations
7. Students re-admitted into the IV Year II Semester of the SITS-R25 Regulations

For every B.Tech. branch there shall be separate set of seven lookup tables.

22.6.2 Applicability of Look-up Table: The above look-up table shall be applicable for i) students who seek readmission from SITS-R22regulations to SITS-R25regulation and are going to be re-admitted in the same JNTUH affiliated non-autonomous college and ii) detained students of one JNTUH affiliated non-autonomous college who seek admission into another JNTUH affiliated non- autonomous college.

For these two categories of students, the Principals of the affiliated colleges need not consult the University for the equivalence courses. However the Principals need to inform in the specified format, the list of such students and equivalences derived from the transitory regulations.

22.6.3 These look-Up Tables are not applicable for the students who seek transfer from i) other Universities to JNTUH affiliated colleges, ii) autonomous to non-autonomous colleges, iii)one autonomous to another autonomous colleges and iv)non-autonomous to autonomous colleges under JNTUH. Such students should consult the University regarding equivalent courses, as was in previous practice.

22.7 The SITS-R25 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 There shall be no transfers from one college to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

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

23.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges, shall be given a chance to write CBTs forgetting CIE component in the equivalent course(s) as per the clearance letter issued by the University.

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 University 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 University authorities.

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

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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 lessthan three academic years and not more than six academic years.
2. The student shall register for 123/124 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 student can avail exemption of courses ***totaling up to ¾ credits*** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project /Industry Oriented Mini Project/Internship, for optional dropout.
4. The students, who fail to fulfill the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
5. TheattendancerequirementsofB.Tech.(Regular)shallbeapplicabletoB.Tech. (LES).
6. **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 fulfillment of attendance requirement.
2	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfillment of attendance requirement. (ii) Must have secured at least 25% of the total credits upto 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 fulfillment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

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

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B.Tech - Mechanical Engineering

Course Structure (SITS - R25)

Applicable From 2025-26 Admitted Batch

Structure Breakup

S. No	Category	Breakup of credits (Total 164 credits)
1	Humanities and Social Sciences, including Management Courses (HSMC)	12
2	Basic Sciences Courses (BS)	14
3	Engineering Sciences Courses, including Workshop, Drawing basics of Electrical/Mechanical/Computer etc.(ES)	22
4	Professional Core Courses (PC)	70
5	Professional Electives (PE)	18
6	Open Electives (OE)	6
7	Skill Development Labs (SD)	6
8	Project work, Seminar and Internship in Industry or elsewhere (PS)	16
TOTAL		**164**

B.Tech - Mechanical Engineering
Course Structure (SITS - R25)
Applicable From 2025-26 Admitted Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	MA101BS	Matrices and Calculus	3	1	0	4
2.	PH102BS	Advanced Engineering Physics	3	0	0	3
3.	ME103ES	C Programming and Data Structures	3	0	0	3
4.	ME104ES	Engineering Mechanics	3	0	0	3
5.	EN105HS	English for Skill Enhancement	3	0	0	3
6.	PH106BS	Advanced Engineering Physics Lab	0	0	2	1
7.	CS107ES	C Programming and Data Structures Lab	0	0	2	1
8.	ME108ES	Engineering Workshop	0	0	2	1
9.	EN109HS	English Language and Communication Skills Lab	0	0	2	1
		Induction Program	-	-	-	-
		Total Credits	**15**	**01**	**08**	**20**

I YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	MA201BS	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2.	CH202BS	Engineering Chemistry	3	0	0	3
3.	CS203ES	Python Programming	3	0	0	3
4.	EE204ES	Elements of Electrical and Electronics Engineering	3	0	0	3
5.	ME303PC	Material Science and Metallurgy	3	0	0	3
6.	ME206ES	Engineering Drawing and Computer-Aided Drafting	2	0	2	3
7.	CH207BS	Engineering Chemistry Lab	0	0	2	1
8.	CS208ES	Python Programming Lab	0	0	2	1
9.	EE209ES	Elements of Electrical and Electronics Engineering Lab	0	0	2	1
		Total Credits	**17**	**00**	**08**	**21**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	MA301BS	Probability, Statistics, and Complex Variables	3	0	0	3
2.	ME302PC	Mechanics of Solids	3	0	0	3
3.	ME205ES	Thermodynamics	3	0	0	3
4.	ME304PC	Production Technology	3	0	0	3
5.	ME305PC	Fluid Mechanics and Hydraulic Machines	3	0	0	3
6.	MA306PC	Computational Mathematics Lab	0	0	2	1
7.	ME307PC	Production Technology Lab	0	0	2	1
8.	ME308PC	Material Science and Mechanics of Solids Lab	0	0	2	1
9.	ME309PC	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
10.	ME310SD	Design Thinking and Ideation	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	ME401PC	Kinematics of Machinery	3	0	0	3
2.	ME402PC	Thermal Engineering – I	3	0	0	3
3.	ME403PC	Design of Machine Elements	3	0	0	3
4.	ME404PC	Instrumentation and Control Systems	3	0	0	3
5.	ME405PC	Operations Research	2	0	0	2
6.	MS406HS	Innovation and Entrepreneurship	2	0	0	2
7.	ME407PC	Conventional and Computer-Aided Machine Drawing	0	0	2	1
8.	ME408PC	Instrumentation and Control Systems Lab	0	0	2	1
9.	ME409PC	Thermal Engineering-I Lab	0	0	2	1
10.	ME410SD	Data Analytics and Python for Engineers	0	0	2	1
11.	VA400HS	Indian Knowledge System	1	0	0	1
		Total Credits	**17**	**0**	**8**	**21**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	ME501PC	Design of Transmission Elements	3	0	0	3
2.	ME502PC	Thermal Engineering – II	3	0	0	3
3.	ME503PC	Metrology and Machine Tools	3	0	0	3
4.		Professional Elective-I	3	0	0	3
5.		Open Elective-I	2	0	0	2
6.	ME504PC	Thermal Engineering - II Lab	0	0	2	1
7.	ME505PC	Metrology and Machine Tools Lab	0	0	2	1
8.	ME506PC	Modelling and Drafting Lab	0	0	2	1
9.	ME507PC	Field-Based Research Project	0	0	4	2
10.	ME508SD	Modelling and Simulation Tools	0	0	2	1
11.	VA500HS/ VA501HS	Gender Sensitization*/ Human Values and Professional Ethics*	1	0	0	0.5+0.5
		Total Credits	**15**	**0**	**12**	**21**

***Note: For the courses Gender Sensitization and Human Values and Professional Ethics -** one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

III YEAR II SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1.	ME601PC	Dynamics of Machinery	3	0	0	3
2.	ME602PC	Heat Transfer	3	0	0	3
3.	MS603HS	Business Economics and Financial Analysis	3	0	0	3
4.		Professional Elective-II	3	0	0	3
5.		Open Elective – II	2	0	0	2
6.	ME604PC	Heat Transfer Lab	0	0	2	1
7.	ME605PC	Applied Manufacturing Lab	0	0	2	1
8.	ME606PC	Kinematics and Dynamics Lab	0	0	2	1
9.	EN607HS	English for Employability Skills Lab	0	0	2	1
10.	ME608SD	Troubleshooting of Mechanical Systems	0	0	2	1
11.	VA600ES	Environmental Science	1	0	0	1
		Total Credits	**15**	**0**	**10**	**20**

IV YEAR I SEMESTER (25Hours)

S.No.	Course Code	Course Title	L	T	P	Credits
1.	ME701PC	Finite Element Methods	3	0	0	3
2.	ME702PC	Robotics and Automation	3	0	0	3
3.	ME703PC	Industrial Engineering and Management	3	0	0	3
4.		Professional Elective – III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – III	2	0	0	2
7.	ME704PC	Computer-Aided Analysis Lab	0	0	2	1
8.	ME705PC	Robotics and Automation Lab	0	0	2	1
9.	ME706PC	Industry-Oriented Mini Project/ Internship	0	0	4	2
		Total Credits	**17**	**0**	**08**	**21**

IV YEAR II SEMESTER (48Hours)

S.No.	Course Code	Course Title	L	T	P	Credits
1.		Professional Elective – V	3	0	0	3
2.		Professional Elective – VI	3	0	0	3
3.	ME801PC	Project Work	0	0	42	14
		Total Credits	**6**	**0**	**42**	**20**

PROFESSIONAL ELECTIVES

Professional Elective-I

ME511PE	Power Plant Engineering
ME512PE	Automobile Engineering
ME513PE	Refrigeration and Air-Conditioning
ME514PE	Renewable Energy Sources

Professional Elective-II

ME621PE	Additive Manufacturing
ME622PE	Micro Manufacturing
ME623PE	Artificial Intelligence in Mechanical Engineering
ME624PE	Advanced Machining Processes

Professional Elective-III

ME731PE	Mechanical Vibrations
ME732PE	Mechanics of Composite Materials and Structures
ME733PE	Design for Manufacturing and Assembly
ME734PE	Mechatronic Systems

Professional Elective-IV

ME741PE	Plant Maintenance and Reliability Engineering
ME742PE	Total Quality Management
ME743PE	Database Management Systems
ME744PE	Production Planning and Control

Professional Elective-V

ME851PE	Product Design and Manufacturing
ME852PE	Computational Fluid Dynamics
ME853PE	Electric and Hybrid Vehicles
ME854PE	Artificial Neural Networks

Professional Elective-VI

ME861PE	Hydraulics and Pneumatics
ME862PE	Sustainable Engineering
ME863PE	AI/ML for Design Analysis
ME864PE	Project Management

OPEN ELECTIVES

Open Elective-I:

ME511OE	Optimization Methods
ME512OE	Industrial Robotics

Open Elective-II:

ME621OE	Artificial Intelligence in Mechanical Engineering
ME622OE	Non-Conventional Sources of Energy

Open Elective-III:

ME731OE	Engineering Materials
ME732OE	Digital Manufacturing

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I Year B.Tech. (MECH) – I Semester Syllabus

SITS – R25

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

MA101BS: MATRICES AND CALCULUS

I Year B.Tech. I Sem. **L T P C**

3 1 0 4

Pre-requisites: Mathematical Knowledge at pre-university level

Objectives: To learn

1. Applying basic operations on matrices and their properties.
2. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
3. Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form
4. Geometrical approach to the mean value theorems and their application to the mathematical problems
5. Finding maxima and minima of functions of two and three variables.
6. Evaluation of multiple integrals and their applications.

Course outcomes: 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 Eigen values and Eigen vectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Solve the applications of the mean value theorems.
5. Find the extreme values of functions of two variables with/ without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices **8 L**

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

UNIT-II: Eigen values and Eigen vectors **10 L**

Linear Transformation and Orthogonal Transformation: Eigen values — Eigen vectors and their properties 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 **10 L**

Limit and Continuous 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 the theorems without proof).

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications) **10 L**

Definitions of Limit and continuity – Partial Differentiation: 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: Multivariable Calculus (Integration) **10 L**

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.

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, 5th Editon, 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, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

PH102BS: ADVANCED ENGINEERING PHYSICS

I Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Pre-requisites: 10+2 Physics

Course Objectives:

1. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
2. To understand fundamental concepts of quantum mechanics and their applications in solids and nanomaterials.
3. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
4. To learn the properties and applications of magnetic and dielectric materials.
5. To explore the working and applications of lasers and fiber optics in modern technology.

Course Outcomes:

1. **CO1**: Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
2. **CO2**: Apply quantum mechanical principles to explain particle behavior and energy band formation in solids.
3. **CO3**: Understand quantum computing concepts, use quantum gates, and explain basic quantum algorithms.
4. **CO4**: Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
5. **CO5**: Explain the principles of lasers and fiber 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, line defects, surface defects, and volume 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, eigen values and eigen functions, expectation value; 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, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover.

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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, Giant Magneto Resistance (GMR) device.

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 Fiber Optics

Introduction to lasers, characteristics of lasers, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO_2 laser, Nd: YAG laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

Introduction to fiber optics, total internal reflection, construction of optical fiber, acceptance angle, numerical aperture, classification of optical fibers, losses in optical fiber, applications: optical fiber for communication systems, 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.
3. 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.

Useful Links

- https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf
- https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
- https://www.fi.muni.cz/usr/gruska/qbook1.pdf
- https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

CS103ES: C PROGRAMMING AND DATA STRUCTURES

I Year B.Tech. I Sem. **L T P C**

3 0 0 3

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching, and sorting.

Course Outcomes:

1. Understand the various steps in Program development.
2. Explore the basic concepts in the C Programming Language.
3. Develop modular and readable C Programs
4. Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
5. Apply data structures such as stacks, queues in problem solving
6. To understand and analyze various searching and sorting algorithms.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development

Introduction to C Language — Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output

Structure of a C Program — Operators, Bit-wise operators, Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Statements.

UNIT - II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.

Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays.

UNIT - III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility,

Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT - IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs — copy, merge files.

UNIT – V

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

Data Structures — Introduction to Data Structures, abstract data types, Linear list — singly linked

list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C — A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

ME104ES: ENGINEERING MECHANICS

I Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of this course are to

1. Explain the resolution of a system of forces, compute their resultant, and solve problems using equations of equilibrium
2. Perform analysis of bodies lying on rough surfaces.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
4. Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
5. Explain the concepts of work energy method and its applications to translation, rotation and plane motion and the concept of vibrations

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

1. Determine resultant of forces acting on a body and analyses equilibrium of a body subjected to a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT - I: Introduction to Engineering Mechanics

Force Systems: Basic concepts, Rigid Body equilibrium, System of Forces, Parallelogram law, Coplanar Concurrent Forces, Components of forces in Space, 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, and Spatial Systems.

UNIT - II: Friction and Centre of Gravity

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

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

UNIT - III: 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. Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem.

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). Work -kinetic energy, power, potential energy. Impulse and momentum: Linear, Angular, Elastic Impact

(Direct and oblique).

UNIT - V: Kinetics of Rigid Bodies

Introduction, Types of motion, Instantaneous center of rotation in plane motion and 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.
4. Engineering Mechanics, Arshad Noor, Zahid and Goel, Cambridge University Press,1st Edition, 2018.
5. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press, 2nd Edition, 2014.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

EN105HS: ENGLISH FOR SKILL ENHANCEMENT

I Year B.Tech. I Sem. **L T P C**

3 0 0 3

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.

LEARNING OBJECTIVES: This course will enable the students to:

a. Improve their vocabulary.
b. Use appropriate sentence structures in their oral and written communication.
c. Develop their reading and study skills.
d. Equip students to write paragraphs, essays, précis and draft letters.
e. Acquire skills for Technical report writing.

COURSE OUTCOMES: Students will be able to:

a. Choose appropriate vocabulary in their oral and written communication.
b. Demonstrate their understanding of the rules of functional grammar and sentence structures.
c. Develop comprehension skills from known and unknown passages.
d. Write paragraphs, essays, précis and draft letters.
e. Write abstracts and reports in various contexts.

SYLLABUS: The course content / study material is divided into **Five Units.**

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

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Black Swan 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

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

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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.***

Note: *Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

- (**Note**: As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech. First Year is* ***Open-ended,*** besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

TEXT BOOK:

1. Board of Editors*. 2025. English for the Young in the Digital World.* Orient Black Swan 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 University 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

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

PH106BS: ADVANCED ENGINEERING PHYSICS LAB

I Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Course Objectives:

1. To provide practical exposure to advanced concepts in solid-state and modern physics.
2. To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances.
3. To perform semiconductor characterization using Hall effect and band gap experiments.
4. To explore the working principles of lasers and optical fibers through hands-on experiments.
5. To develop skills in data analysis, interpretation, and scientific reporting.

Course Outcomes:

1. **CO1:** Synthesize and analyze nanomaterials such as magnetite (Fe_3O_4) using chemical methods.
2. **CO2:** Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
3. **CO3:** Characterize semiconductors using Hall effect and energy gap measurement techniques.
4. **CO4:** Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
5. **CO5:** Apply scientific methods for accurate data collection, analysis, and technical report writing.

List of Experiments:

1. Synthesis of magnetite (Fe_3O_4) powder using the sol-gel method.
2. Determination of the energy gap of a semiconductor.
3. V-I characteristic of solar cell
4. Determination of the magnetic moment of a bar magnet and the horizontal Earth's magnetic field.
5. Study of the B-H curve of a ferromagnetic material.
6. Study of the P-E loop of a given ferroelectric crystal.
7. Determination of the dielectric constant of a given material.
8. Determination of Curie's temperature of a given ferroelectric material.
9. A) Determination of the wavelength of a laser using a diffraction grating.
   B) Study of V-I & L-I characteristics of a given laser diode.
10. A) Determination of the numerical aperture of a given optical fiber.
    B) Determination of bending losses of a given optical fiber.

Note: Any 8 experiments are to be performed.

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CS107ES: C PROGRAMMING & DATA STRUCTURES LAB

I Year B.Tech. I Sem. **L T P C**

0 0 2 1

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes:

1. Develop modular and readable C Programs
2. Solve problems using strings, functions
3. Handle data in files
4. Implement stacks, queues using arrays, linked lists.
5. To understand and analyze various searching and sorting algorithms.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. The Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve the Towers of Hanoi problem.
8. Write a C program which takes two integer operands and one operator from the user, performs the operation, and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
9. Write a C program to find both the largest and smallest numbers in a list of integers.
10. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices
    ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or — 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers
    (Note: represent complex numbers using a structure.)

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18.
   i. Write a C program that copies one file to another.
   ii. Write a C program to reverse the first n characters in a file.
   (Note: The file name and n are specified on the command line.)

19.
   i. Write a C program to display the contents of a file.
   ii. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

20. Write a C program that uses functions to perform the following operations on singly linked list.:
   i) Creation ii) Insertion iii) Deletion iv) Traversal

21. Write C programs that implement a stack (its operations) using
   i) Arrays ii) Pointers

22. Write C programs that implement a Queue (its operations) using
   i) Arrays ii) Pointers

23. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii)Insertion sort

24. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
   i) Linear search ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

ME108ES: ENGINEERING WORKSHOP

I Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Practical skill

Course Objectives:

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting, welding, sheet metal, and machining
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

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

1. Understand the basic manufacturing processes and operations.
2. Use hand tools and equipment safely and efficiently.
3. Perform basic operations in carpentry, fitting, welding, sheet metal work, and machining
4. Read and interpret workshop drawings
5. Develop teamwork, time management, and quality awareness in a workshop environment.

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 Semi- circular fit
iii. **Tin Smithy**: Square Tin, Rectangular Tray and Conical Funnel
iv. **Foundry**: Preparation of Green Sand Mould using Single Piece and Split Pattern
v. **Welding Practice:** Arc Welding and Gas Welding
vi. **House wiring**: Parallel and Series, Two-way Switch and Tube Light
vii. **Black Smithy**: Round to Square, Fan Hook and S- Hook

2. TRADES FOR DEMONSTRATION AND EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

TEXT BOOKS:

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.

REFERENCE BOOKS:

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

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EN109HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

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.

Listening Skills:

Objectives

1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practise speaking in social and professional contexts

Learning Outcomes: Students will be able to:

1. Listen actively and identify important information in spoken texts
2. Interpret the speech and infer the intention of the speaker
3. Improve their accent for intelligibility
4. Speak fluently with clarity and confidence
5. Use the language in real life situations

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

a. **Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
b. **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:

1. 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:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. 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.

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I Year B.Tech. (MECH) – II Semester Syllabus

SITS – R25

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

MA201BS: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

I Year B.Tech. II Sem. **L T P C**

3 0 0 3

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Methods of solving the differential equations of first and higher order.
2. Concept, properties of Laplace transforms.
3. Solving ordinary differential equations using Laplace transform techniques.
4. The physical quantities involved in the engineering field related to vector-valued functions
5. The basic properties of vector-valued functions and their applications to line, surface, and volume integrals

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

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equations and apply the concept of differential equations to real-world problems.
3. Use the Laplace transform techniques for solving Ordinary Differential Equations.
4. Evaluate the Line, Surface, and Volume integrals and convert them from one to another

UNIT-I: First Order Ordinary Differential Equations **8 L**

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 Differential Equations of Higher Order **10 L**

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 **10 L**

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 integrals by Laplace transforms– Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by the Laplace Transform method.

UNIT-IV: Vector Differentiation **10 L**

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

UNIT-V: Vector Integration **10 L**

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, 5th Edition, 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, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

CH202BS: ENGINEERING CHEMISTRY

I Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion, along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:

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, lubricants 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: [8]

Introduction, types of hardness, and units– Estimation of hardness of water by the 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 breakpoint chlorination Defluorination. - Nalgonda technique.

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: [8]

Introduction - Electrode potential, standard electrode potential, types of electrodes, Nernst equation (no derivation), Galvanic cell, cell representation, EMF of cell- Numerical problems. Reference electrodes - Primary reference electrode — Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Determination of pH of an unknown solution using SHE and a Calomel electrode.

Corrosion: Introduction - Definition**,** causes and effects of corrosion - Theories of corrosion, chemical and electrochemical corrosion - Mechanism of electrochemical 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: [8]

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). 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.

UNIT - IV: Polymers: [8]

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 themo plastics and thermosetting plastics, Fiber reinforced plastics (FRP). Conducting Polymers: Definition and Classification with
examples, Mechanism of Conduction in trans- and applications of conducting polymers.
Biodegradable polymers: Polylactic acid and its applications.

UNIT-V - Advanced Functional Materials:[8]

Cement - Portland cement - Its composition, setting, and hardening.
Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications. Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in the dye industry, IR spectroscopy in night vision security, Pollution Under Control- CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

SUGGESTED TEXT BOOKS:

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.

REFERENCE TEXT BOOKS:

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.
5. Challenges and Opportunities in Green Hydrogen by **Editors:** Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, https://www.worldscientific.com/ doi/epdf/10.1142/13094
7. E-Content- https://doi.org/10.1142/13094 | October 2023
8. E-books: https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2up

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CS203ES: PYTHON PROGRAMMING

I Year B.Tech. II Sem. **L T P C**

3 0 0 3

Prerequisites: Basic knowledge of computer fundamentals, C programming.

Course Objectives:

Introduce the fundamentals of Python programming for problem-solving.

1. Develop skills to write structured, modular, and efficient Python code.
2. Enable students to use Python's built-in data structures and libraries effectively.
3. Provide knowledge on file handling, exception handling, and object-oriented programming in Python.
4. Equip students with the ability to apply Python for real-world applications including data processing and automation.

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.

CO–PO Mapping

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	1	0	0	2	2	1	3
CO2	3	3	3	2	3	1	0	0	2	2	1	3
CO3	3	3	3	2	3	1	0	1	2	2	1	3
CO4	3	3	2	2	3	1	0	1	2	2	1	3
CO5	3	3	3	2	3	1	1	1	3	3	2	3

UNIT-1 – 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-2 – 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-3 – 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, datetime), Packages in Python.

UNIT-4 – 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-5 – 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.

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EE204ES: ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

I Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the concepts of electrical circuits and their components
2. To understand magnetic circuits, DC circuits, and AC single-phase and three-phase circuits
3. To study and understand the different types of DC, AC machines, and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits
3. To study the working principles of Electrical Machines
4. To introduce components of Low Voltage Electrical Installations
5. To identify and characterize diodes and various types of transistors.

UNIT - I:

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, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II:

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. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - III:

Electrical Machines: Working principle, equivalent circuit and construction of Single-phase Transformer, Working principle of Three-phase Transformer, Working principle and construction of DC Machines and its applications, Working principle of three-phase Induction Motor and Synchronous Generators and their applications.

UNIT - IV:

P-N Junction and Zener Diode: Principle of Operation, Diode equation, Volt, Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters — Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

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UNIT - V:

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M S Sukija and TK Nagasarkar, Oxford University, 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. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

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ME303PC: MATERIAL SCIENCE AND METALLURGY

I Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand the structure and properties of engineering materials.
2. To study phase diagrams and heat treatment processes of ferrous and non-ferrous alloys.
3. To analyze the mechanical behavior of materials under various loading conditions.
4. To identify microstructures and predict material performance in service conditions.
5. To introduce testing methods and failure mechanisms of materials.

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. Analyze mechanical testing results and failure mechanisms like fatigue, creep, and fracture.
6. 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.
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 – IV:
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.

UNIT – V:
Materials in nano technology: Semiconductor Nanomaterials (Zinc oxide nano materials, titanium dioxide nanoparticles, Metal nanoparticles, ceramic nano materials metal nano particles (Silver, gold, iron and copper), applications, bio materials and other recent materials

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:

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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.

Materials Science and Engineering: An Introduction, William. D. Callister and David G. Rethwisch, John Wiley and Sons, 10th Edition, 2018

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

ME206ES: ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING

I Year B.Tech. II Sem. **L T P C**

2 0 2 3

Course Objectives:

1. To introduce the fundamentals of engineering drawing and projection systems.
2. To develop skills in constructing orthographic, isometric, and sectional views.
3. To train students in interpreting and creating technical drawings using CAD tools.
4. To familiarize students with dimensioning standards and drafting conventions.
5. To bridge manual drafting techniques with computer-aided drafting practices.

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

1. Understand and apply the principles of orthographic and isometric projections.
2. Create sectional views and dimensioned drawings using BIS standards.
3. Use CAD software to generate 2D engineering drawings.
4. Visualize and construct solid models from 2D views.
5. Interpret and produce engineering drawings of mechanical components and assemblies.
6. Demonstrate drafting skills for practical and industrial applications.

UNIT – I: Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections, including the Rectangular Hyperbola, General method only. Cycloid, Epicycloid, and Hypocycloid.

UNIT - II: Orthographic Projections (Conventional and Computer Aided)

Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer-aided orthographic projections, points, lines, and planes. Introduction to Computer-Aided drafting, views, commands, and conics.

UNIT – III: Projections of Regular Solids (Conventional and Computer Aided)

Simple positions inclined to one plane and inclined to both planes- Prism, Cylinder, Pyramid, Cone. Computer-aided projections of solids.

UNIT – IV: Section of solids (Conventional):

Sectional views of Right Regular Solids- Prism, Cylinder, Pyramid, and Cone. Computer-aided projections of sectional views of solids.

Development of Surfaces (Conventional):

Prism and Cylinder-Parallel line method, Pyramid and Cone- radial line method.

UNIT – V: Isometric Projections (Conventional and Computer Aided)

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 Views to Orthographic Views and Vice Versa, Conventions. Conversion of orthographic projection into an isometric view.

Note:

1. The End Semester Examination will be in conventional mode.
2. CIE – I will be in conventional mode.
3. CIE–II will be using a Computer.

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.

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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, 3rd Edition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer-Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

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CH207BS: ENGINEERING CHEMISTRY LAB

I Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Course Description: The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

Course Objectives

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate (KMnO4) using a calibration curve.

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:

I. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.

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 $KMnO_4$.
   2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone

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.

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REFERENCE BOOKS:

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).

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CS208ES: PYTHON PROGRAMMING LAB

I Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in Python
- To Handle Strings and Files in Python

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

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

Note: The lab experiments will be like the following experiment examples.

List of Experiments:

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.
1. Start a Python interpreter and use it as a Calculator.
2. Write a program to calculate compound interest when principal, rate and number of periods are given.
3. Read the name, address, email and phone number of a person through the keyboard and print the details.
4. Print the triangle below using for loop.
   5
   4 4
   3 3 3
   2 2 2 2
   1 1 1 1 1
5. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character(use 'if-else-if' ladder)
6. Python program to print all prime numbers in a given interval (use break)
7. Write a program to convert a list and tuple into arrays.
8. Write a program to find common values between two arrays.
9. 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.
10. 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.
11. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
12. 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.
13. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add

"l", "a", and the empty string.

14. 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.
15. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
16. Remove the given word in all the places in a string?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 lower case without using a built-in function?
17. Writes a recursive function that generates all binary strings of n-bit length
18. Write a python program that defines a matrix and prints
19. Write a python program to perform multiplication of two square matrices
20. 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.
21. Use the structure of exception handling all general-purpose exceptions.
22. 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.
23. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.
24. 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.
25. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.
26. Write a python code to read a phone number and email-id from the user and validate it for correctness.
27. Write a Python code to merge two given file contents into a third file.
28. 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.
29. Write a Python code to Read text from a text file, find the word with most number of occurrences
30. 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.
31. Import numpy, Plotpy and Scipy and explore their functionalities.
32. Install NumPypackage with pip and explore it.
33. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
34. 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, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

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 Data Science, 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

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EE209ES: ELEMENTS OF ELECTRICAL AND ELECTRONIC ENGINEERING LAB

I Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Basic Electrical and Electronics Engineering

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits.
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors.
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.
5. To identify and characterize diodes and various types of transistors.

List of Experiments:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a SinglePhase Transformer
   (ii) Verification of Relationship between Voltages and Currents (StarDelta, DeltaDelta, Delta Star, StarStar) in a Three Phase Transformer
3. Measurement of Active and Reactive P ower in a balanced Threephase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Threephase Induction Motor
6. NoLoad Characteristics of a Threephase Alternator

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 and Zener as voltage Regulator
4. Input and Output characteristics of Transistor in CB, CE configuration
5. Full Wave Rectifier with and without filters
6. Input and Output characteristics of FET in CS configuration

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.

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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. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

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II Year B.Tech. (MECH) – I Semester Syllabus

SITS – R25

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

MA301BS: PROBABILITY, STATISTICS AND COMPLEX VARIABLES

II Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

- The ideas of random variables and various discrete and continuous probability distributions and their properties.
- The statistical methods of studying data samples.
- Differentiation and integration of complex-valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

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

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

UNIT - I: Random Variables and Probability Distributions **8 L**

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 **10 L**

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) **10 L**

Statistical Hypotheses: General Concepts — Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean.Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution.

UNIT-IV-Applied Statistics: **10 L**

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves – Correlation and Regression – Rank correlation.

UNIT - V: Complex Differentiation **10 L**

Differentiation of Complex functions — Analyticity — Cauchy-Riemann equations (without proof) — Harmonic Functions – Finding harmonic conjugate – Milne Thomson method.

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.

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.

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ME302PC: MECHANICS OF SOLIDS

II Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Engineering Mechanics

Course Objectives: The objectives of this course are to:

1. Understand the concepts of internal forces, moments, stress, strain, and deformation of solids with applications to bars, beams, and columns.
2. Learn the fundamentals of applying equilibrium, compatibility, and force - deformation relationships to structural elements.
3. Study twisting of circular bars and hollow shafts acted on by torsional moments.
4. Define the state of stress at a point on a body and to develop stress transformations.
5. Introduce the concept of theories of elastic failure and their significance in the design.

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

1. Evaluate the internal forces, moments, stresses, strains, and deformations in structures made of various materials acted on by a variety of loads.
2. Draw axial force, shear force and bending moment diagrams for beams and frames.
3. Develop the Bending and Torsion formula and apply to the design of beams and shafts.
4. Use the stress transformation equations to find the state of stress at a point for various rotated positions of the stress element and display the same in graphical form as Mohr's circle.
5. Understand the different criteria for the safety of the component by applying the theories of elastic failure.

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. 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.
4. Engineering Mechanics of Solids, Egor P. Popov and Toader A. Balan, PHI Learning, 2nd Edition, 2010.
5. Strength of Materials, G. H. Ryder, Macmillan Long Man Publications, 3rd Edition, 1961.
6. Strength of Materials, W. A. Nash and M. C. Potter, McGraw Hill, 5th Edition, 2011.

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ME205ES: THERMODYNAMICS

II Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Engineering Chemistry and Physics

Course Objective:

1. To introduce the basic concepts and laws of thermodynamics.
2. To apply the first and second laws to closed and open systems.
3. To understand the properties of pure substances and their use in thermodynamic processes.
4. To study the working principles and performance of thermodynamic cycles.
5. To prepare students for applications in engines, power plants and refrigeration.

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

1. Understand the basic thermodynamic concepts, systems, and properties.
2. Apply the first law to both closed and open systems.
3. Analyze thermodynamic processes using property diagrams and tables.
4. Apply the second law and evaluate entropy changes and efficiency.
5. Examine the performance of power and refrigeration cycles.
6. Solve real-world thermodynamic problems related to mechanical systems.

Tables, Codes: Steam Tables and Mollier Chart, Refrigeration Tables

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, Principles of Thermometry, Reference Points, Constant Volume gas Thermometer, Scales of Temperature, Ideal Gas Scale, 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, including steam calorimetry.

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

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 and Thermodynamic Cycles

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.

Thermodynamic Cycles: Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle, Description and representation on P–V and T- S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis, Comparison of Cycles. Refrigeration Cycles: Bell Coleman cycle, Vapour compression cycle, Ammonia, Water Vapor Absorption Cycle, Performance Evaluation.

TEXTBOOKS:

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.
4. Engineering Thermodynamics, Rogers, Pearson, 4th Edition, 1996.
5. Engineering Thermodynamics, M Achuthan, PHI, 2nd Edition, 2009.
6. Thermodynamics for Engineers, Kenneth A. Kroos, Merle C. Potter, Cengage, 1st Edition, 2014.

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.ME304PC: PRODUCTION TECHNOLOGY

II Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Engineering Workshop

Course Objectives:

1. To expose the students to understand the concept of basic casting processes and furnaces.
2. To provide a technical understanding of various joining processes used in the manufacturing industry.
3. To impart the students to the concepts of solidstate welding processes.
4. To teach the concepts of rolling and various press working operations.
5. To provide a technical understanding of different metal forming processes like extrusion, forging and high energy rate forming processes.

Course Outcomes: Student will be able to:

1. Elaborate the fundamentals of various moulding, casting techniques and furnaces.
2. Identify the importance of permanent joining and principle behind different welding processes.
3. Explain the concepts of solidstate welding processes.
4. Understand the concepts of rolling and sheet metal operations in metal working.
5. Elaborates the uniqueness of extrusion, forging and high energy rate forming processes in metal working.

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 requirements in the above operations.

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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. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Mikell P. Groover, Wiley, 7th Edition, 2023.
4. Production Technology Vol. 1, Sreeramulu, WILEY, 1st Edition, 2018.
5. Production Engineering, P.C. Sharma, S. Chand Publishing, 8th Edition, 1999.
6. Manufacturing processes H. S. Shan, Cambridge University Press, 2nd Edition,2017.
7. Production Technology: Manufacturing Processes, Technology and AutomationVol.1, R. K. Jain, Khanna Publishers, 19th Edition, 2009.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES (UGC – AUTONOMOUS)

ME305PC: FLUID MECHANICS AND HYDRAULIC MACHINES

II Year B.Tech. I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Engineering Mechanics, Thermodynamics

Course Objectives: To enable the student:

1. To understand the basic principles of fluid mechanics.
2. To identify various types of flows.
3. To understand boundary layer concepts and flow through pipes.
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps.

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts.

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.

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UNIT – V: 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. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International publishers, 1st Edition, 2002.
5. Hydraulic Machines, T.R. Banga and S.C. Sharma, Khanna Publishers, 7th Edition, Rpt. 2019.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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MA306PC: COMPUTATIONAL MATHEMATICS LAB
(Using Python/MATLAB software)

II Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

Course Objectives: To learn

1. Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
2. Solution of Algebraic and Transcendental Equations using Python/MATLAB
3. Solve problems of Linear system of equations
4. Solve problems of **First-Order ODEs Higher order linear differential equations with** constant coefficients

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

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

* **Visualize all solutions Graphically through programmes**

UNIT - I: Eigen values and Eigenvectors: **6P**

Programs:

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

UNIT-II: Solution of Algebraic and Transcendental Equations **6P**

Bisection method, 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: **6P**

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 **8P**

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 **6P**

Programs:

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

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TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. 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.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME307PC: PRODUCTION TECHNOLOGY LAB

II Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Production Technology

Course Objectives:

1. To provide hands-on experience with casting, welding, forming, and machining operations.
2. To help students understand the working principles of manufacturing processes.
3. To expose students to tools, machines, and equipment used in production workshops.
4. To develop safety awareness and quality control in manufacturing practices.
5. To bridge theoretical knowledge with practical application of manufacturing methods.

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

1. Demonstrate casting practices such as pattern making and sand molding.
2. Perform welding operations like arc welding, gas welding, and spot welding.
3. Operate basic machining tools such as lathe, drilling, and milling machines.
4. Understand sheet metal fabrication, bending, and joining processes.
5. Analyze process parameters and their influence on product quality.
6. Practice safety, accuracy, and productivity in production environments.

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

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME308PC: MATERIAL SCIENCE AND MECHANICS OF SOLIDS LAB

II Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Material Science and Metallurgy; Mechanics of Solids

MATERIAL SCIENCE:

Course Objectives:

1. Learn the fundamental concepts of Metallurgy and Material Science in the context of manufacturing processes.
2. Understand how raw materials are converted into useful products.
3. Gain knowledge of the basic structure and crystal arrangements of materials.
4. Classify and distinguish between different microstructures of steels, cast irons, and non-ferrous alloys.

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

1. Design different crystal structures and their models.
2. Infer the microstructures developed for different ferrous and nonferrous metals.
3. Correlate the microstructures, properties, performance and processing of alloys.

MATERIAL SCIENCE

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.

MECHANICS OF SOLIDS LAB:

Course Objectives:

1. Understand the fundamental concepts of stress, strain, and deformation in solids.
2. Apply the principles to analyze structural elements such as bars, beams, and columns.
3. Study the engineering properties of materials in detail.
4. Emphasize the application of equilibrium, compatibility, and force-deformation relationships.
5. Introduce advanced methods of structural analysis, including the flexibility and stiffness methods.
6. Build upon foundational knowledge from the Engineering Mechanics course.

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

1. Analyze the behavior of the solid bodies subjected to various types of loading.
2. Apply knowledge of materials and structural elements to the analysis of simple structures.
3. Undertake problem identification, formulation and solution using a range of analytical methods
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
5. Expectation and capacity to undertake lifelong learning.

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

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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.

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ME309PC: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

II Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Course Objectives:

1. To understand the basic principles of fluid mechanics.
2. To identify various types of flows.
3. To understand boundary layer concepts and flow through pipes.
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps.

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts.

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.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME310SD: DESIGN THINKING AND IDEATION

II Year B.Tech. I Sem.

L	T	P	C
0	0	2	1

Course Objectives:

1. To introduce the concept and importance of design thinking in solving complex problems.
2. To enable students to empathize with users and identify genuine needs.
3. To facilitate ideation and creative thinking for problem solving.
4. To guide students in developing prototypes and testing solutions.
5. To build storytelling and communication skills for presenting ideas effectively.

Course Outcomes:

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.

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II Year B.Tech. (MECH) – II Semester Syllabus

SITS – R25

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ME401PC: KINEMATICS OF MACHINERY

II Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Basic principles of Mechanics

Course Objectives: The objectives of this course are

1. To introduce the concept of machines, mechanisms, and related terminologies and the relative motion, velocity, and accelerations of the various elements in a mechanism.
2. To make the students become familiar with the most commonly used mechanisms, such as four-bar, slider crank, double slider crank mechanisms, and their inversions.
3. To provide an overview of straight-line motion mechanisms, steering mechanisms, and Hooke's joint.
4. To familiarize with higher pairs like cams and principles of cam design.
5. To understand the kinematic analysis of gears and gear trains.

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

1. Understand the various elements in mechanisms and the inversions of commonly used mechanisms such as four-bar, slider crank, and double slider crank mechanisms.
2. Draw the velocity and acceleration polygons for a given configuration of a mechanism.
3. Understand the conditions for straight line motion mechanisms, steering mechanisms, and the usage of Hooke's joint.
4. Draw the displacement diagrams and cam profile diagrams for followers executing different types of motions and various configurations of followers.
5. Calculate the number of teeth and velocity ratio required for a given combination of gears.

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. Kliens construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

Analysis of Mechanisms: Analysis of slider crank chain for displacement, Velocity and Acceleration of slider, Acceleration diagram for a given mechanism.

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.

Tangent cam with Roller follower, Circular arc cam with straight, Concave and Convex flanks.

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. Theory of Machines, Thomas Bevan, CBS Publishers and Distributors, 3rd Edition,2005.

REFERENCE BOOKS:

1. A Textbook of Theory of Machines, R. K. Bansal and J. S. Brar, Laxmi Publications, 5th Revised Edition, 2010.
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. Mechanisms and Machine Theory, Rao. J.S. and Dukkipati. R.V., Wiley Eastern Ltd., 2nd Edition, 1992.
5. Theory of Machines, S.S. Rattan, Tata McGraw Hill, 4th Edition, 2014.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME402PC: THERMAL ENGINEERING - I

II Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Thermodynamics

Course Objective:

1. Explain the Components of IC Engines and systems.
2. Analyze the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
3. Understand and evaluate the performance analysis of the major components and systems of IC engines and their applications.
4. Explore to the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5. Understand the significance of gas turbines in real context in power generation.

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

1. Elaborate the working principles of IC Engine systems and its classification.
2. Explore the combustion stages of SI and CI engines, and factors influence for better combustion.
3. Evaluate the testing and performance parameters of IC engines.
4. Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.
5. Understand the working principle of gas turbine and its classification with thermodynamic analysis.

UNIT – I: Power Cycles and IC Engines Classification

Otto, Atkinson, 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 andCI 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.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME403PC: DESIGN OF MACHINE ELEMENTS

II Year B.Tech. 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 Objectives:

1. To introduce the basic principles of machine component design.
2. To understand the various modes of failure in mechanical components under different loading conditions.
3. To learn how to apply theories of failure in the safe design of machine elements.
4. To develop the ability to design mechanical components like joints, couplings, shafts, and springs.
5. To familiarize with the use of standard codes and design data books in mechanical design.

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

1. Analyze stress and strain in mechanical components and predict failure using appropriate criteria.
2. Design machine elements like bolts, riveted and welded joints based on static and dynamic loading.
3. Design shafts, couplings, and keys considering strength and rigidity.
4. Select and design helical and leaf springs for energy storage applications.
5. Apply appropriate design standards and codes to real-world design problems.
6. Use design data books and manufacturer's catalogues for component selection and validation.

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.
4. Design of Machine Elements, V. M. Faires, Macmillan, 4th Edition, 1965.
5. Design of Machine Elements - I, M.H Annaiah, New Age International Publishers, 1st Edition, 2010.

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ME404PC: INSTRUMENTATION AND CONTROL SYSTEMS

II Year B.Tech. II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics - I, Thermodynamics, Basic of Electrical and Electronics Engineering.

Course Objectives:

1. To impart the basic knowledge of the functional blocks of measurement systems.
2. To provide technical understanding of various Temperature and pressure measuring instruments.
3. To expose the students to know the working of various physical variable Level, Flow, Speed and Acceleration measuring instruments.
4. To understand the working of various physical and Electrical Variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. To understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

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

1. Know the basic knowledge of the functional blocks of measurement systems.
2. Describe the working of various physical variable Temperature and pressure measuring instruments.
3. Explain the working of various physical variable Level, flow, Speed and Acceleration measuring instruments.
4. Understand the working of various physical and Electrical Variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. Understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

UNIT – I: Principles of measurement

Measurement systems, Generalized configuration and functional description of measuring instruments, Examples. Static and Dynamic performance characteristics, Sources of errors, Classification and elimination of errors.

Measurement of Displacement: Theory and construction of various transducers to measure displacement, Using Piezo electric, Inductive, Capacitance, Resistance, Ionization and Photo electric transducers, Calibration procedures.

UNIT – II: Measurement of Temperature and Pressure

Measurement of Temperature: Various Principles of Measurement, Classification, Expansion Types: Bimetallic Strip, Liquid in glass Thermometer. Electrical Resistance Type: Thermistor, Thermocouple, RTD, Radiation Pyrometry, Optical Pyrometer, Changes in Chemical Phase, Fusible Indicators and Liquid crystals.

Measurement of Pressure: Different principles used, Classification, Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement, Thermal conductivity gauges, Ionization pressure gauges, McLeod pressure gauge.

UNIT – III: Measurement of Level, Flow and Speed

Measurement of Level: Direct methods, Indirect methods, Capacitive, Radioactive, Ultrasonic,

Magnetic, Cryogenic Fuel level indicators, Bubbler level indicators.
Flow measurement: Rotameter, Magnetic, Ultrasonic, Turbine flowmeter, Hotwire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non-contact type Stroboscope. Measurement of Acceleration and Vibration: Different simple instruments, Principles of Seismic instruments, Vibrometer and accelerometer using this principle, Piezo electric accelerometer.

UNIT – IV: Stress, Strain Measurements

Various types of stress and strain measurements, Selection and installation of metallic strain gauges, Electrical strain gauge, Gauge factor, Method of usage of resistance strain gauge for bending, Compressive and tensile strains, Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.
Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power, Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V: Elements of Control Systems

Introduction, Importance, Classification, Open and closed systems, Servomechanisms, Examples with block diagrams, Temperature, speed and position control systems, Transfer functions, First and Second order mechanical systems.

TEXT BOOKS:

1. Principles of Industrial Instrumentation and Control Systems, Chennakesava R Alavala, Cengage Learning, 1st Edition, 2009.
2. Instrumentation – Operations, Measurement, Scope and Application of Instruments, N.V.S. Raju, B.S. Publications, 2016.

REFERENCE BOOKS:

1. Measurement Systems: Applications and design, E. O. Doebelin, TMH, Tata Mcgraw Hill, 6th Edition, 2017.
2. Mechanical Measurements and Control, D. S. Kumar, Metropolitan Book Co. Pvt. Ltd., 2015.
3. Instrumentation, Measurement and Analysis, B.C. Nakra and K.K. Choudhary, TMH, 4th Edition, 2016.
4. Experimental Methods for Engineers, Jack P. Holman, Mc Graw Hill, 8th Edition, 2011.
5. Mechanical and Industrial Measurements, R. K. Jain, Khanna Publishers, 11th Edition, 1995.
6. Mechanical Measurements, Sirohi and Radhakrishna, New Age International, 3rd Edition, 2013.

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ME405PC: OPERATIONS RESEARCH

II Year B.Tech. II Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. To introduce the principles of Operations Research and its applications in engineering and management.
2. To develop problem-solving skills for linear programming, transportation, and assignment problems.
3. To understand and apply models for decision making, queuing theory, and inventory control.
4. To formulate real-world problems using operations research tools.
5. To use optimization techniques for resource allocation and scheduling.

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

1. Formulate and solve linear programming problems using graphical and simplex methods.
2. Apply transportation and assignment models to practical situations.
3. Use decision-making tools like game theory and decision trees under uncertainty.
4. Analyze waiting lines and inventory systems using queuing and inventory models.
5. Solve project scheduling problems using PERT and CPM techniques.
6. Utilize operations research methods for optimization in manufacturing and service systems.

UNIT – I:

Introduction and LPP: Definition of Operations Research, Characteristics and phases of OR, Types of models, Operations Research models, applications.

Linear Programming Problem Formulation, Graphical solution, Simplex method. Artificial variable techniques: Two-phase method, Big- M method.

UNIT – II:

Transportation problem: Formulation, Optimal solution, Unbalanced transportation problem, Degeneracy.

Assignment problem: Formulation, Optimal solution, Variants of Assignment problem, Travelling salesman problem.

UNIT – III:

Sequencing: Introduction, Flow, Shop sequencing, n jobs through two machines – n jobs through three machines, Job shop sequencing, Two jobs through 'm' machines.

Replacement: Introduction, Replacement of items that deteriorate with time, When money value is not counted and counted, Replacement of items that fail completely, Group Replacement.

UNIT – IV:

Theory of Games: Introduction, Terminology, Solution of games with saddle points and without saddle points. 2 x 2 games, Dominance principle, m x 2 and 2 x n games, Graphical method.

Inventory: Introduction, Single item, Deterministic models, Wilson, Harris Model, EOQ Derivation, Shortages model, Continuous Supply Model, P- System and Q- System. Purchase inventory models with one price break and multiple price breaks, Stochastic models.

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UNIT – V:

Waiting lines: Introduction, Terminology, Single channel, Poisson arrivals and Exponential service times with infinite population.

Dynamic Programming: Introduction, Terminology, Bellman's principle of optimality, Applications of Dynamic programming, Shortest path problem, Linear programming problem.

TEXT BOOK:

1. Operations Research Theory and Applications, J. K. Sharma, Trinity, 6th Edition, 2016.
2. Operations Research, NVS Raju, BSP Publications, 1st Edition, 2019.

REFERENCE BOOKS:

1. Operations Research, S. D. Sharma, Kedar Nath Ram Nath, 2020th edition, 2014.
2. Operations Research: An Introduction, Hamdy A. Taha, PHI, 10th Edition, 2017.
3. Introduction to Operations Research, Hillierand Lieberman, McGraw Hill, 7th Edition, 2002.
4. Operations Research, A. M. Natarajan, P. Balasubramaniam and A. Tamilarasi, Pearson Education, 3rd Edition, 2020.
5. Operations Research, Wagner, PHI Publications, 2nd Edition, 1975.
6. Operations Research, M.V. Durga Prasad, K. Vijaya Kumar Reddy and J. Suresh Kumar, Cengage Learning, 1st Edition, 2012.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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MS406HS: INNOVATION AND ENTREPRENEURSHIP

II Year B.Tech. II Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR

Course Outcomes:

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. Analyze Business and financial planning models and Go-to-Market strategies.
5. Able to 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

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ME407PC: CONVENTIONAL AND COMPUTER-AIDED MACHINE DRAWING

II Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Engineering graphics

Course objectives:

1. To understand the principles and standards of engineering and machine drawing.
2. To develop skills in visualizing and creating orthographic views of machine components.
3. To learn part modeling and assembly drawing using CAD tools.
4. To interpret symbols, tolerances, and fits used in machine drawing.
5. To prepare detailed drawings of mechanical parts and assemblies as per industry standards.

Course Outcomes:

1. Interpret and apply BIS conventions for machine drawing.
2. Draw orthographic views, sectional views, and dimensioned drawings of machine components.
3. Understand the concepts of limits, fits, and tolerances used in engineering design.
4. Create part models and assembly drawings using AutoCAD or other drafting software.
5. Develop detailed production-ready drawings for various machine elements and assemblies.
6. Visualize, model, and document complete assemblies as per standard practice.

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. Rivetted joints.
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Drawing of Machine Elements: Using Computer aided drafting in addition to conventional drawing

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.

Assembly Drawings: Using Computer aided drafting in addition to conventional drawing

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.

Note: External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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ME408PC: INSTRUMENTATION AND CONTROL SYSTEMS LAB

II Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Basic principles of Instrumentation and control systems

Course Objectives:

1. To provide hands,on experience in calibration and characterization of various measuring instruments.
2. To develop skills in identifying and analyzing measurement errors.
3. To enable students to perform data analysis using regression techniques.
4. To familiarize students with modern instrumentation used in industrial process control**.**

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

1. Characterize and calibrate measuring devices.
2. Identify and analyze errors in measurement.
3. Analyze measured data using regression analysis.
4. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

List of Experiments:

Calibration and Study of:

1. Pressure Gauges.
2. Transducer for temperature measurement.
3. LVDT transducer for displacement measurement.
4. Strain gauge for temperature measurement.
5. Thermocouple for temperature measurement.
6. Capacitive transducer for angular displacement.
7. Photo and magnetic speed pickups for the measurement of speed.
8. Resistance Temperature Detector (RTD) for temperature measurement.
9. Rotameter for flow measurement.
10. Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. McLeod gauge for low pressure.

Measurement and control of:

1. Pressure of a process using SCADA system.
2. Level in a tank using capacitive transducer with SCADA.
3. Temperature of a process using resistance temperature detector with SCADA.

Note: Perform a minimum of any 12 out of the 14 Experiments.

LAB MANUALS:

1. Laboratory Manual for Instrumentation and Control Engineering, S. R. Vijayalakshmi, Vikas Publishing House, 2021.
2. Instrumentation and Control Systems Lab Manual, Dr. A. K. Mittal and Dr. A. K. Bandyopadhyay, S. K. Kataria and Sons, 2020.

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ME409PC: THERMAL ENGINEERING- I LAB

II Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Prerequisite: Thermodynamics and Thermal Engineering – I

Course Objectives:

1. To provide practical knowledge of the working and performance of internal combustion engines and air compressors.
2. To familiarize students with various testing methods like Morse test, retardation test, and heat balance.
3. To enhance the understanding of the effect of different parameters such as airfuel ratio and compression ratio on engine performance.
4. To impart handson experience in dismantling and assembling of engine components.
5. To introduce basic operations and applications of boilers and their accessories.

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

1. Understand the working principles of internal combustion engines and air compressors.
2. Perform experiments to evaluate the performance of twostroke and fourstroke SI and CI engines.
3. Conduct various tests like Morse, Retardation, Motoring, and Heat Balance on engines.
4. Analyze the effect of air,fuel ratio and compression ratio on engine performance.
5. Study volumetric efficiency of air compressors and understand their operational characteristics.
6. Disassemble and assemble engine components and study the function of boilers.

List of Experiments:

I.C. Engines:

1. Valve, Port Timing Diagrams.
2. Performance Test for 4 Stroke SI engines.
3. Performance Test for 2 Stroke SI engines.
4. Morse, Retardation, Motoring Tests.
5. Heat Balance – CI, SI Engines.
6. Economical Speed Test on a SI engine.
7. Effect of Air Fuel Ratio in a SI engine.
8. Performance Test on a 4Stroke CI Engine at constant speed.
9. Performance Test on Variable Compression Ratio Engine.

Other Experiments:

1. Volumetric efficiency of Air Compressor Unit.
2. Disassembly, Assembly of Engines.
3. Study of Boilers.

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.

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ME410SD: DATA ANALYTICS AND PYTHON FOR ENGINEERS

II Year B.Tech. II Sem.

L	T	P	C
0	0	2	1

Course Objectives:

1. To introduce Python programming for data handling and analysis.
2. To enable data import, cleaning, and transformation.
3. To develop skills in data visualization and statistical analysis.
4. To apply data analytics to engineering problem solving.
5. To introduce realtime data analysis using tools like Jupyter or Streamlit.

Course Outcomes:

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.
6. 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).

SIDDHARTHA INSTITUTE OF TECHNOLOGY & SCIENCES
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VA400HS: INDIAN KNOWLEDGE SYSTEM

II Year B.Tech. 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 practised 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 Objectives: This course aims:

1. To provide a tribune of the rich culture and traditions of Indian knowledge system to students of various disciplines.
2. To introduce historical account on the education and scientific literature available in ancient Indian traditions and its connections with ancient Indian Philosophy
3. To give insights about the applications of Bharatiya Jnana Parampara
4. To introduce Indian approach towards health and wellbeing
5. To elaborate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

Course Outcomes: 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 1: **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 2: 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 3: 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 4: Introduction to Ancient Indian Wellness Systems

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

Unit 5: 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