



# Course Structure and Syllabus

(R23 Regulations)

## Mechanical Engineering

B.Tech – I & II Year

(Applicable for the Batches admitted from 2023-2024)



# NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet – 522601, Palnadu District, AP  
(Sponsored by Gayatri Educational Development Society), Narasaraopet.

Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada, Code: 47.

Accredited by NBA (Tier 1), NAAC "A+" Grade. NIRF: 2022 (251-300 Band),

RTA Approved Pollution test Centre, & ISO 9001: 2015 Certified Institution.

Phone: 08647-239923

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# Academic Regulations (R23) for B.Tech. (Regular)

(Effective for the students admitted into I year from the Academic Year 2023-2024 onwards)

## 1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
- Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
  - Registers for 160 credits and secures all 160 credits.

## (b) Award of B.Tech. Degree with Honors

A student will be declared eligible for the award of the B.Tech with Honors if he/she fulfils the following:

- Student secures additional 15 credits fulfilling all the requisites of a B.Tech. Program i.e., 160 credits.
- Registering for Honors is optional.
- Honors is to be completed simultaneously with B.Tech. programme.

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

## 3. Admissions

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

## 4. Program related terms

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

Credit definition:

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

- a) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- b) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

**5. Semester/Credits:**

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

**6. Structure of the Undergraduate Programme**

All courses offered for the undergraduate program (B.Tech.) are broadly classified as follows:

| S. No. | Category   | Breakup of Credits (Total 160) | Percentage of total credits | AICTE Recommendation (%) |
|--------|--|--------------------------------|-----------------------------|--------------------------|
| 1.     | Humanities and Social Science including Management (HM)                                    | 13                             | 8 %                         | 8 – 9%                   |
| 2.     | Basic Sciences (BS)  | 20                             | 13 %                        | 12 - 16%                 |
| 3.     | Engineering Sciences (ES)  | 23.5                           | 14%                         | 10 – 18%                 |
| 4.     | Professional Core (PC)   | 54.5                           | 34 %                        | 30 – 36%                 |
| 5.     | Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC) | 33                             | 21 %                        | 19 - 23%                 |
| 6.     | Internships & Project work (PR)  | 16                             | 10 %                        | 8 – 11%                  |
| 7.     | Mandatory Courses (MC)   | Non-credit                     | Non-credit                  | -                        |

**7. Course Classification:**

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

| S.No. | Broad Course Classification | Course Category                                 | Description  |
|-------|-----------------------------|---|--|
| 1.    | Foundation Core Courses     | Foundation courses                              | Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses                   |
| 2.    | Core Courses                | Professional Courses (PC) Core                  | Includes subjects related to the discipline/department/branch of parent Engineering  |
| 3.    | Elective Courses            | Professional Elective Courses (PE)              | Includes elective subjects related to the parent discipline/department/ branch of Engineering  |
|       |                             | Open Elective Courses (OE)                      | Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering |
|       |                             | Domain specific skill enhancement courses (SEC) | Interdisciplinary/job-oriented/domain courses which are relevant to the industry   |
| 4.    | Project & Internships       | Project   | B.Tech. Project or Major Project   |
|       |                             | Internships                                     | Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship  |
| 5.    | Audit Courses               | Mandatory non-credit courses                    | Covering subjects of developing desired attitude among the learners  |

**8. Programme Pattern**

- i. Total duration of the B.Tech (Regular) Programme is four academic years.
- ii. Each academic year of study is divided into two semesters.
- iii. Minimum number of instruction days in each semester is 90 days.
- iv. There shall be mandatory student induction program for freshers, with a three- week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
- v. Health/wellness/yoga/sports and NCC /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
- vi. Courses like Environmental Sciences, Indian Constitution, and Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
- ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
- x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.
- xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
- xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
- xv. Undergraduate degree with Honors is introduced by the College for the students having good academic record.
- xvi. College will plan to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- xvii. College will assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.
- xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

## 9. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, and mandatory courses with no credits shall be evaluated for 30 mid semester marks. A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. Incase of a mandatory course, he/she should secure 40% of the total marks.

### THEORY COURSES

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

- For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70marks for the End-Examination.
- For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- If any course contains two different branch subjects, the syllabus shall be written into two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
- If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given the same subject code with an extension of “T” for theory subject and “P” for practical subject.

#### a) Continuous Internal Evaluation

- For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
- Objective paper shall contain 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

#### Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted either online or offline by the respective department on the day of subjective paper test.
- If conducted offline, the midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall. Then the descriptive question paper and the answer booklet shall be distributed. After 90 minutes the answered booklets are collected back.

- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- Assignment Test if conducted like slip tests, the following procedure may be followed: Two assignment tests may be conducted before first and second mid examinations for 5 marks. First assignment test may be conducted after the 1<sup>st</sup> Unit of syllabus. 5 or 6 questions may be announced in advance. On the day of test, 2 questions will be given to each student randomly. The test may be conducted in the first hour for 30 minutes. Second assignment test may be conducted in the similar way after the completion of 3<sup>rd</sup> Unit of syllabus.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
- iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
- v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

**For Example:**

Marks obtained in first mid: 25 Marks obtained in second mid: 20

Final mid semester Marks:  $(25 \times 0.8) + (20 \times 0.2) = 24$

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

Marks obtained in first mid: Absent Marks obtained in second mid: 25

Final mid semester Marks:  $(25 \times 0.8) + (0 \times 0.2) = 20$

**b) End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.
- iii) There shall be 2 short answer questions from each unit.
- iv) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- v) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

- i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
- ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
- iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.



**PRACTICAL COURSES**

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

- a) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
- b) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the regularity/record/viva and 15 marks for the internal test.
- c) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and External examiner from the other reputed Institutions.
- Procedure: 20 marks
  - Experimental work & Results: 30 marks
  - Viva voce: 20 marks.
- In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.
- d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

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

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective papers shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

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

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

- i) There shall be five skill-oriented courses offered during III to VII semesters.
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the Principal.
- iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
- v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
- vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the concerned department's HOD at the beginning of the semester.
- vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the Principal.

#### **11. Massive Open Online Courses (MOOCs):**

A Student has to pursue and complete one course compulsorily through MOOCs approved by the HOD. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

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



## 12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the College shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

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

**Note:** Students shall be permitted to register for MOOCs offered through online platforms approved by the respective Department from time to time.

## 13. Academic Bank of Credits (ABC)

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

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

## 14. Mandatory Internships

### Summer Internships

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

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

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College.

#### **Full Semester Internship and Project work:**

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

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

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

#### **15. Guidelines for offering a Minor**

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

- i) The Minor program requires the completion of 12 credits in Minor stream chosen.
- ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but may be waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
- iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

**Note:** A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

**16. Guidelines for offering Honors**

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

- i) Honors is introduced in the curriculum of all B.Tech. Programs offering a major degree and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 15 credits (4 theory courses of 3 credits each and One MOOC course of 3 credits) for award of B.Tech. (Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
- iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum one subject per semester pertaining to the Honors from IV Semester onwards.
- iv) The college will arrange separate class work and timetable of the courses offered under Honors program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi) Students can complete the MOOC course in online platforms like SWAYAM with a minimum duration of 12 weeks for 3-credits satisfying the criteria for credit mobility. Student can register for online MOOC course in any semester starting from the 4<sup>th</sup> Semester. Should submit the MOOC certificate before the commencement of 7<sup>th</sup> Semester End Examinations. For the 4 theory courses offered by the college, the teaching and evaluation procedure shall be similar to regular B.Tech courses.
- vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme. Honors courses should be completed in a single attempt otherwise the registration for honors stands cancelled.
- x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.
- xii) Student who registered for Honors should pass all subsequent regular semester courses in a single attempt with a minimum of 7 SGPA.

**Enrolment into Honors:**

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the SGPA obtained in each semester in the major degree program. 7 SGPA shall be maintained in all semesters up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 SGPA (in all semesters) without any backlog subjects will be permitted to register

for Honors.

- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
- iv) Transfer of credits from Honors to regular B.Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

**Registration for Honors:**

- i) The eligible and interested students shall apply through the HOD of his/her parent department. Selected students shall be permitted to register the courses under Honors.
- ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
- iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
- iv) There is no fee for registration of subjects for Honors program offered in offline mode.

**17. Attendance Requirements:**

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the College.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
- viii) For induction programme attendance shall be maintained as per AICTE norms.

**18. Promotion Rules:**

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

- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per College norms.
- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any *decimal* fraction should be **rounded off to lower** digit) up to in the subjects that have been studied up to III semester.
- iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any *decimal* fraction should be **rounded off to lower** digit) in the subjects that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student

may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

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

### 19. Grading:

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

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

**Structure of Grading of Academic Performance**

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

- i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered in the next supplementary examination.
- ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

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

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

$$SGPA = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where,  $C_i$  is the number of credits of the  $i$ th subject and  $G_i$  is the grade point scored by the student in the  $i$ th course.

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

$$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where " $S_i$ " is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits up to that semester.

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



Semester Grade Point Average (SGPA) for a semester will be computed only for those students, who have successfully passed all the courses of that semester. Similarly Cumulative Grade Point Average (CGPA) will be computed for the current semester only for those candidates who successfully completed all the courses starting from the 1st Semester to the Current Semester.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D, E and F.

#### **Award of Class:**

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

| <b>Class Awarded</b>         | <b>CGPA Secured</b>                               |
|------------------------------|---|
| First Class with Distinction | $\geq 7.5$ (Without any supplementary appearance) |
| First Class                  | $\geq 6.5 < 7.5$                                  |
| Second Class                 | $\geq 5.5 < 6.5$                                  |
| Pass Class                   | $\geq 5.0 < 5.5$                                  |

- **Note:** Students who have written supplementary examinations to fulfil the credit requirement will not be awarded First Class with Distinction. For such students the highest degree that is awarded will be First Class Only.

#### **CGPA to Percentage conversion Formula – $(\text{CGPA} - 0.5) \times 10$**

#### **20. With-holding of Results**

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

#### **21. Multiple Entry / Exit Option**

##### **(a) Exit Policy:**

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

- UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)** - Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

##### **(b) Entry Policy:**

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

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



**22. Gap Year Concept:**

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

**23. Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B.Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

**24. Minimum Instruction Days for a Semester:**

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

**25. Medium of Instruction:**

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

**26. Student Transfers:**

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

**27. General Instructions:**

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

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**ACADEMIC REGULATIONS (R23) FOR B.TECH. (LATERAL ENTRY SCHEME)**

*(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year 2024-2025 onwards)*

**1. Award of the Degree**

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

- (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
- (ii) Registers for 120 credits and secures all 120 credits.

**(b) Award of B.Tech. Degree with Honors**

A student will be declared eligible for the award of the B.Tech with Honors if he/she fulfils the following:

- (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. Program i.e., 120 credits.
- (ii) Registering for Honors is optional.
- (iii) Honors is to be completed simultaneously with B.Tech. programme.

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

**3. Minimum Academic Requirements**

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

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.  
And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

**4. Course Pattern**

- i) The entire course of study is three academic years on semester pattern.
- ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
- iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B.Tech. Four-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme).

## MALPRACTICES RULES

### DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.
- Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained here under.

|      | <b>Nature of Malpractices/<br/>Improper conduct</b>   | <b>Punishment</b>   |
|------|---|---|
|      | <i>If the candidate:</i>  |   |
| 1(a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination). | Expulsion from the examination hall and cancellation of the performance in that subject only.   |
| 1(b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.   | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.   |
| 2.   | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.   | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college. |

|    |   |   |
|----|---|---|
| 3. | Impersonates any other candidate in connection with the examination.  | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and to be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.   | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.   |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.  | Cancellation of the performance in that subject.  |
| 6. | Refuses to obey the orders of the Chief Superintendent/Assistant– Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the Police and a police case is registered against them.   |

|     |  |   |
|-----|--|---|
|     | assaults the officer-in- charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. |   |
| 7.  | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.  | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8.  | Possess any lethal weapon or firearm in the examination hall.  | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.  |
| 9.  | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.  | Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.                                |
| 10. | Comes in a drunken condition to the examination hall.  | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.  |

|     |  |   |
|-----|--|---|
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.  | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 12. | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the college for further action to award suitable punishment. |   |

**OTHER MATTERS:**

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAPCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Controller of Examinations and Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

**GENERAL:**

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words “he”, “him”, “his” occur in the regulations, they include “she”, “her”, “hers”.
3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
5. Malpractice cases will be indicated in the grade card with letters ‘MP’.





# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, Andhra Pradesh (India)






For Constituent Colleges and Affiliated Colleges of JNTUK

# Ragging

## Prohibition of ragging in educational institutions Act 26 of 1997

### Salient Features

- ⇒ Ragging within or outside any educational institution is prohibited.
- ⇒ Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

|   | Imprisonment upto  |   | Fine Upto           |
|---|--|---|---------------------|
| Teasing,<br>Embarrassing &<br>Humiliation   |  <b>6 Months</b>  | + | <b>Rs. 1,000/-</b>  |
| Assaulting or Using<br>Criminal force or<br>Criminal intimidation                             |  <b>1 Year</b>    | + | <b>Rs. 2,000/-</b>  |
| Wrongfully restraining<br>or confining or<br>causing hurt                                     |  <b>2 Years</b>   | + | <b>Rs. 5,000/-</b>  |
| Causing grievous hurt,<br>kidnapping or Abducts<br>or rape or committing<br>unnatural offence |  <b>5 Years</b>   | + | <b>Rs. 10,000/-</b> |
| Causing death or<br>abetting suicide  |  <b>10 Months</b> | + | <b>Rs. 50,000/-</b> |

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

## ANNEXURE-I

### COMMUNITY SERVICE PROJECT

Experiential learning through community engagement

As per the decision of the concerned department BOS

#### Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

#### Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.
- Implementation of Community Service Project
- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.

- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
  - The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water
-

## **EXPECTED OUTCOMES**

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

#### **Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

#### **Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

#### **Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

#### **Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

#### **Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

## **SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

The following is the recommended list of projects for engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

### **For Engineering Students**

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries

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**INDUCTION PROGRAMME**

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

**I B.Tech I SEMESTER**

| S. No        | Subject                                    | Course Code | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits     |
|--------------|--|-------------|-----------|----------------|----------------|-------------|---|---|---|-------------|
| 1            | LINEAR ALGEBRA & CALCULUS                  | R23CC1101   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 2            | INTRODUCTION TO PROGRAMMING                | R23CC1102   | ES        | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 3            | ENGINEERING PHYSICS                        | R23CC1106   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 4            | BASIC ELECTRICAL & ELECTRONICS ENGINEERING | R23CC1107   | ES        | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 5            | ENGINEERING GRAPHICS                       | R23CC1108   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 6            | COMPUTER PROGRAMMING LAB                   | R23CC11L1   | ES        | 30             | 70             | 100         | 0 | 0 | 3 | 1.5         |
| 7            | IT WORKSHOP                                | R23CC11L5   | BS&H      | 30             | 70             | 100         | 0 | 0 | 2 | 1           |
| 8            | ENGINEERING PHYSICS LAB                    | R23CC11L6   | ES        | 30             | 70             | 100         | 0 | 0 | 3 | 1.5         |
| 9            | EEE WORKSHOP                               | R23CC11L7   | BS&H      | 30             | 70             | 100         | 0 | 0 | 2 | 1           |
| 10           | NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE  | R23CC11M C2 | BS&H      | 100            | -              | 100         | - | - | 1 | 0.5         |
| <b>TOTAL</b> |  |             |           |                |                |             |   |   |   | <b>20.5</b> |



| I B.TECH<br>I-SEMESTER | L                         | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|---------------------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 3                         | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE: R23CC1101        | LINEAR ALGEBRA & CALCULUS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Grasping fundamental principles in linear algebra, including linear transformations, solving systems of linear equations, and applying matrix calculus.
- To become proficiency in solving computational problems of linear algebra.
- To acquire knowledge on mean value theorems in calculus.
- Familiarization about the techniques in calculus and multivariate analysis.

**COURSE OUTCOMES:**

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

**CO1: Solve** the system of linear equations and transformations.

**CO2: Analyze** the applications of matrices in various fields and obtain Eigen values and Eigenvectors.

**CO3: Analyze** mean value theorems to real life problems

**CO4: Apply** the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering

**CO5: Identify** the area and volume by interlinking them to appropriate double and triple integrals.

**UNIT-I:****MATRICES**

Introduction to Linear Transformation-Rank of a matrix by Echelon form and normal form - Cauchy- Binet formulae (without proof) - Inverse of non-singular matrices by Gauss-Jordan method - System of linear equations: Solving system of homogeneous and non-homogeneous equations - Gauss elimination method, Jacobi and Gauss-Seidel iteration methods.

Applications: L-C-R Circuits

**UNIT-II:****EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION**

Eigenvalues, Eigenvectors and their properties - Diagonalization of a matrix - Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem - Quadratic form and nature of a quadratic form - Reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT-III:****CALCULUS**

Mean Value Theorems (without proofs): Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation - Cauchy's mean value theorem - Taylor's and Maclaurin's theorems with remainders - Problems and applications on the above theorems.

**UNIT-IV:**

**PARTIAL DIFFERENTIATION AND APPLICATIONS**

**(MULTI VARIABLE CALCULUS)**

Functions of several variables: Continuity and Differentiability - Partial derivatives – Homogeneous function-Euler's Theorem on homogeneous functions-Total derivatives - Chain rule - Taylor's and Maclaurin's series expansion of functions of two variables - Jacobians - Functional dependence - Maxima and minima of functions of two variables - Method of Lagrange's multipliers.

**UNIT-V:**

**MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS)**

Double integrals - Triple integrals - Change of order of integration - Change of variables to polar, cylindrical and spherical coordinates - Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**TEXTBOOKS:**

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44<sup>th</sup> Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10<sup>th</sup> Edition.

**REFERENCE BOOKS:**

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14<sup>th</sup> Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5<sup>th</sup> Edition (9<sup>th</sup> reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5<sup>th</sup> Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9<sup>th</sup> edition.
5. Higher Engineering Mathematics, H. K. Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021).

| <b>I B.TECH<br/>I SEMESTER</b> | <b>L</b>                           | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|--------------------------------|------------------------------------|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                | <b>3</b>                           | <b>0</b> | <b>0</b> | <b>30</b>                 | <b>70</b>                 | <b>100</b>             | <b>3</b>       |
| <b>CODE :R23CC1102</b>         | <b>INTRODUCTION TO PROGRAMMING</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVES:**

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Infer** the basic concepts of computers, algorithms and Flowcharts.

**CO2: Develop** programs using appropriate control structures.

**CO3: Write** programs using arrays and strings.

**CO4: Develop** programs using structures and pointers.

**CO5: Make use of** functions and file Operations in C programming for a given application.

**UNIT I****INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operators, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problemsolving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

**UNIT II:****CONTROL STRUCTURES**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

**UNIT III:****ARRAYS AND STRINGS**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Strings: Introduction – Reading Strings – Writing Strings – String Manipulation functions -Array of Strings.

**UNIT IV:****POINTERS & USER DEFINED DATA TYPES**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

**UNIT V:**

**FUNCTIONS & FILE HANDLING**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

**Note:** The syllabus is designed with C Language as the fundamental language of implementation.

**TEXTBOOKS:**

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 2005.
2. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3<sup>rd</sup> edition.
3. How to Solve it by Computer, R G Dromey, Pearson Education.

**REFERENCE BOOKS:**

1. Computing Fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2<sup>nd</sup> edition
3. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1998.

| I B.TECH<br>I SEMESTER | L                   | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|---------------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 3                   | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE:R23CC1106         | ENGINEERING PHYSICS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To bridge the gap between the Physics at 10+2 level and UG level engineering courses
- Identifying the importance of Lasers and optical fibers,
- Enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics,
- Introduce novel concepts of magnetic materials and superconductors, physics of semiconductors and smart materials.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO 1: Analyze** the intensity variation of Laser light and it's propagation in optical fibers.

**CO 2: Familiarize** with the basics of crystals and their structures.

**CO 3: Summarize** various types of Magnetic materials and Super conductors.

**CO 4: Explain** the basic concepts of Quantum Mechanics and the band theory of solids.

**CO 5: Identify** the type of semiconductor and smart materials.

**UNIT I:****LASERS AND OPTICAL FIBERS**

**LASERS:** Introduction – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Population inversion - Einstein's coefficients and relation between them - Ruby laser – Helium Neon laser- Semiconductor laser-Applications.

**OPTICAL FIBERS:** Introduction- Basic Structure and Principle of optical fiber - Acceptance angle – Acceptance cone - Numerical Aperture - Step Index and Graded index fibers -Applications.

**UNIT II:****CRYSTALLOGRAPHY AND X-RAY DIFFRACTION**

**CRYSTALLOGRAPHY:** Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC.

**X-RAY DIFFRACTION:** Miller indices – separation between successive (hkl) planes.

Bragg's law - crystal structure determination by Laue's and powder methods.

**UNIT III:****MAGNETIC MATERIALS AND SUPERCONDUCTIVITY**

**MAGNETIC MATERIALS:** Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility, permeability and relation between them - Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Hysteresis - soft and hard magnetic materials.

**SUPERCONDUCTIVITY:** Introduction- Properties, Meissner effect - Type-I and Type-II super conductors- BCS Theory- AC and DC Josephson effect-Applications.

**UNIT IV:**

**QUANTUM MECHANICS AND FREE ELECTRON THEORY**

**QUANTUM MECHANICS:** de-Broglie's matter Waves – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent wave equation – Particle in a one-dimensional infinite potential well.

**FREE ELECTRON THEORY:** Classical free electron theory (Qualitative with discussion of merits and demerits) – electrical conductivity based on Classical free electron theory -Quantum free electron theory – Fermi energy- Fermi-Dirac distribution.

**UNIT V:**

**SEMICONDUCTORS AND SMART MATERIALS**

**SEMICONDUCTORS:** Formation of energy bands – classification of solids – Types of semiconductors - Drift and diffusion currents – Einstein's equation - Hall Effect and its applications.

**SMART MATERIALS:** Introduction – properties- types of smart materials- shape memory alloys – piezoelectric materials- magnetostrictive materials – Thermoelectric materials- magneto rheological fluids- electro rheological fluids- Chromic materials – Engineering applications of smart materials.

**TEXTBOOKS:**

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).

**REFERENCE BOOKS:**

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).



| I B.TECH<br>I SEMESTER | L   | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|---|---|---|-------------------|-------------------|----------------|---------|
|                        | 3   | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE :R23CC1107        | BASIC ELECTRICAL & ELECTRONICS<br>ENGINEERING |   |   |                   |                   |                |         |

## PART A: BASIC ELECTRICAL ENGINEERING

### COURSE OBJECTIVES

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/electronic engineering and to acquire fundamental knowledge in the relevant field.

### COURSE OUTCOMES:

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

**CO1: Explain** the fundamental laws and concept of DC and AC circuits.

**CO2: Demonstrate** the working and operating principles of electrical machines, measuring instruments.

**CO3: Demonstrate** the working and operating principles of different power generation stations.

**CO4: Calculate** electrical load, electricity bill of residential and commercial buildings and safety measures.

### UNIT I:

#### DC & AC CIRCUITS

**DC Circuits:** Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

**AC Circuits:** A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

### UNIT II:

#### MACHINES AND MEASURING INSTRUMENTS

**Machines:** Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

**Measuring Instruments:** Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone Bridge.

### UNIT III:

#### ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES

**Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

**Electricity bill:** Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

**Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

**TEXTBOOKS:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**REFERENCE BOOKS:**

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.

**Web Resources:**

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

## **PART B: BASIC ELECTRONICS ENGINEERING**

**COURSE OBJECTIVES:**

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Describe** the working of diode and explore the operation of BJT and its applications.

**CO2: Describe** the working of Rectifiers and amplifiers in electronic circuits.

**CO3: Manipulate** numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems

**CO4: Design** and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.

**UNIT I:**

**SEMICONDUCTOR DEVICES**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

**UNIT II:**

**BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**

Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

**UNIT III:**

**DIGITAL ELECTRONICS**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops(S-R, J-K, D and T Flip flops), Registers(4-bit Shift Register - serial input and output) and counters (Ripple Counters, Binary Ripple Counter, Ring Counter) (Elementary Treatment only)

**TEXTBOOKS:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

**REFERENCE BOOKS:**

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Salivahanan, N. Suresh Kumar, A. Vallavaraj, “Electronic Devices and Circuits” Tata McGraw-Hill, Second Edition, 2008.
3. Jacob Millman, C. Halkies, C.D. Parikh, Satyabrata Jit, “Integrated Electronics”, Tata McGraw-Hill, Second Edition, 2011.

| I B.TECH<br>I SEMESTER | L                    | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|----------------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 1                    | 0 | 4 | 30                | 70                | 100            | 3       |
| CODE : R23CC1108       | ENGINEERING GRAPHICS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

**COURSE OUTCOMES:**

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

**CO1: Construct** the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections.

**CO2: Construct** orthographic projections of points, lines, planes and solids in front, top and Side views.

**CO3: Analyze** and draw projection of solids in various positions in first Quadrant.

**CO4: Develop** the sections of Solids & Development of Surfaces.

**CO5: Compare & Draw** isometric Views & Orthographic Views.

**UNIT I**

**INTRODUCTION:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

**CURVES:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

**Scales:** Plain scales, diagonal scales and vernier scales.

**UNIT II**

**ORTHOGRAPHIC PROJECTIONS:** Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

**PROJECTIONS OF STRAIGHT LINES:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

**PROJECTIONS OF PLANES:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

**UNIT III**

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

#### **UNIT IV**

**SECTIONS OF SOLIDS:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

**DEVELOPMENT OF SURFACES:** Methods of Development: Parallel line development and radial linedevelopment. Development of a cube, prism, cylinder, pyramid and cone.

#### **UNIT V**

**CONVERSION OF VIEWS:** Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

**COMPUTER GRAPHICS:** Creating 2D&3D drawings of objects including PCB and Transformationsusing Auto CAD (*Not for end examination*).

#### **TEXTBOOK:**

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

#### **REFERENCE BOOKS:**

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.

| I B.TECH<br>I SEMESTER | L                        | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|--------------------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 0                        | 0 | 3 | 30                | 70                | 100            | 1.5     |
| CODE:R23CC11L1         | COMPUTER PROGRAMMING LAB |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** and trace the execution of programs written in C language

**CO2: Implement** programs with appropriate control structures for solving the problems

**CO3: Develop** C programs which utilize memory efficiently using programming constructs like pointers

**CO4: Code, Debug and Execute** programs to demonstrate the applications of arrays, functions, files and various other concepts in C

**UNIT1****WEEK 1**

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Basic commands of Linux (sudo, pwd, cd, ls, cat, cp, mv, mkdir, rmdir, rm, touch, locate, find, grep, df, du, head, tail, diff, tar, chmod, chown, kill, ping)
- Exposure to Turbo C, gcc
- Writing simple programs using printf(), scanf()

**WEEK 2**

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

**Suggested Experiments /Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 2:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- Sum and average of 3 numbers
- Conversion of Fahrenheit to Celsius and vice versa
- Simple interest calculation

**WEEK 3**

**Objective:** Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:



**Lab 3:** Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

## UNIT II

### WEEK 4

**Objective:** Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

**Suggested Experiments/Activities:**

**Tutorial 4:** Operators and the precedence and as associativity:

**Lab 4:** Simple computational problems using the operator's precedence and associativity

- i) Evaluate the following expressions.
  - a.  $A+B*C+(D*E) + F*G$
  - b.  $A/B*C-B+A*D/3$
  - c.  $A+++B---A$
  - d.  $J= (i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

### WEEK 5

**Objective:** Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if\*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

**Lab 5:** Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

### WEEK 6

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

**Lab 6:** Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- v) Construct a pyramid of numbers.

**UNIT III****WEEK 7:**

**Objective:** Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:**

**Tutorial 7:** 1 D Arrays: searching.

**Lab 7:** 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

**WEEK 8:**

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

**Suggested Experiments/Activities:**

**Tutorial 8:** 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

**UNIT IV****WEEK: 9**

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc(), calloc(), realloc() and free() functions. Gain experience processing command-line arguments received by C

**Suggested Experiments/Activities:**

**Tutorial 9:** Pointers, structures and dynamic memory allocation

**Lab 9:** Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

**WEEK 10:**

**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

**Suggested Experiments/Activities:****Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists**Lab10:** Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

**UNIT V****WEEK 11:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:****Tutorial 11:** Functions, call by value, scope and extent,**Lab 11:** Simple functions using call by value, solving differential equations using Euler's theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

**Suggested Experiments/Activities:****Tutorial 12:** Recursion, the structure of recursive calls**Lab 12:** Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

**WEEK 13:**

**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

**Suggested Experiments/Activities:****Tutorial 13:** Call by reference, dangling pointers**Lab 13:** Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK14:**

**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

**Suggested Experiments/Activities:****Tutorial 14:** File handling**Lab 14:** File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

**WEEK 15: Virtual Labs:**

<https://ps-iiith.vlabs.ac.in/List%20of%20experiments.html>

**TEXTBOOKS:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

**REFERENCE BOOKS:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.

| I B.TECH<br>I SEMESTER | L           | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|-------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 0           | 0 | 2 | 30                | 70                | 100            | 1       |
| CODE:R23CC11L5         | IT WORKSHOP |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, spread sheets and Presentation tools.

**COURSE OUTCOMES:**

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

**CO1: Identify** Hardware components and inter dependencies.

**CO2: Utilize** Antivirus s/w to safeguard computer systems while using Internet

**CO3: Develop** a Document or Presentation

**CO4: Make use of** spreadsheets to perform calculations

**CO5: Utilize** the AI Tool Chat GPT

**PC HARDWARE & SOFTWARE INSTALLATION**

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

**INTERNET & WORLD WIDE WEB**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

### **LaTeX and WORD**

**Task 1 – Word Orientation:** The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent(FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

**Task 3:** Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

### **EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

### **LOOKUP/VLOOKUP**

**Task 1:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

### **POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.



**AI TOOLS – Chat GPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2:** Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

**REFERENCE BOOKS:**

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2<sup>nd</sup> edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfinson and Ken Quamme. – CISCO Press, Pearson Education, 3<sup>rd</sup> edition IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan – CISCO Press, Pearson Education, 3<sup>rd</sup> edition

| I B.TECH<br>I SEMESTER | L                       | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|-------------------------|---|---|-------------------|-------------------|----------------|---------|
|                        | 0                       | 0 | 3 | 30                | 70                | 100            | 1.5     |
| CODE: R23CC11L6        | ENGINEERING PHYSICS LAB |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO: 1 Operate** optical instruments like travelling microscope and spectrometer

**CO: 2 Estimate** the wavelengths of different colors using diffraction grating.

**CO: 3 Plot** the intensity of the magnetic field of circular coil carrying current with distance.

**CO: 4 Calculate** the band gap of a given semiconductor.

**LIST OF EXPERIMENTS:**

1. Determination of radius of curvature of a given plano convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

**Note:** Any **TEN** of the listed experiments are to be conducted. Out of which any **TWO** experiments may be conducted in virtual mode.

**REFERENCES:**

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

**URL:** [www.vlab.co.in](http://www.vlab.co.in)

| I B.TECH<br>I SEMESTER | L | T            | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|---|--------------|---|-------------------|-------------------|----------------|---------|
|                        | 0 | 0            | 2 | 30                | 70                | 100            | 1       |
| CODE :R23CC11L7        |   | EEE WORKSHOP |   |                   |                   |                |         |

## PART A: ELECTRICAL ENGINEERING LAB

### COURSE OBJECTIVES:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

### COURSE OUTCOMES:

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

**CO1: Measure** voltage, current and power in an electrical circuit.

**CO2: Measure** of Resistance using Wheatstone bridge

**CO3: Discover** critical field resistance and critical speed of DC shunt generators.

**CO4: Investigate** the effect of reactive power and power factor in electrical loads.

### Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
- Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
- Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
  - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
  - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

### LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheatstone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises
8. Determination of open circuit and short circuit parameters of a 1-phase transformer (Content Beyond syllabus)

**REFERENCE BOOKS:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
  2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
  3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition
- \*Note:** Minimum Six Experiments to be performed.

**PART B: ELECTRONICS ENGINEERING LAB****COURSE OBJECTIVES:**

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** the characteristics of various electronic components.

**CO2: Implement** Rectifiers circuits.

**CO3: Design** Amplifiers circuit.

**CO4: Examine** the operation of Logic gates.

**LIST OF EXPERIMENTS**

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.
9. Design a Full Adder Circuit and verify the truth table. (Content beyond syllabus)

**Tools / Equipment Required:** DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

**REFERENCES:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

**Note:** Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

| I B.TECH<br>I SEMESTER | L  | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|--|---|---|-------------------|-------------------|----------------|---------|
|                        | 0  | 0 | 1 | 100               | -                 | 100            | 0.5     |
| SCODE :R23CC11MC2      | NSS/NCC/SCOUTS & GUIDES/COMMUNITY<br>SERVICE |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Understand** the importance of discipline, character and service motto.

**CO2: Solve** some societal issues by applying acquired knowledge, facts, and techniques.

**CO3: Explore** human relationships by analyzing social problems.

**CO4: Determine** to extend their help for the fellow beings and downtrodden people.

**CO5: Develop** leadership skills and civic responsibilities.

**UNIT I****ORIENTATION**

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

**Activities:**

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

**UNIT II****NATURE & CARE****Activities:**

- Best out of waste competition.
- Poster and signs making competition to spread environmental awareness.
- Recycling and environmental pollution article writing competition.
- Organising Zero-waste day.
- Digital Environmental awareness activity via various social media platforms.
- Virtual demonstration of different eco-friendly approaches for sustainable living.
- Write a summary on any book related to environmental issues.

**UNIT III Community Service****Activities:**

- Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities experts-etc.
- Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
- Conducting consumer Awareness. Explaining various legal provisions etc.

- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

**Reference Books:**

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., “Introduction to Environmental Engineering”, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

**Evaluation Guidelines:**

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



**I B.Tech II SEMESTER**

| S. No        | Subject                                  | Course Code | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits     |
|--------------|--|-------------|-----------|----------------|----------------|-------------|---|---|---|-------------|
| 1            | DIFFERENTIAL EQUATIONS & VECTOR CALCULUS | R23CC1201   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 2            | COMMUNICATIVE ENGLISH                    | R23CC1206   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 2           |
| 3            | ENGINEERING CHEMISTRY                    | R23CC1208   | BS&H      | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 4            | ENGINEERING MECHANICS                    | R23CC1209   | ES        | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 5            | BASIC CIVIL & MECHANICAL ENGINEERING     | R23CC1212   | ES        | 30             | 70             | 100         | 3 | 0 | 0 | 3           |
| 6            | ENGINEERING WORKSHOP                     | R23CC12L9   | ES        | 30             | 70             | 100         | 0 | 0 | 3 | 1.5         |
| 7            | ENGINEERING MECHANICS LAB                | R23ME12L7   | ES        | 30             | 70             | 100         | 0 | 0 | 3 | 1.5         |
| 8            | ENGINEERING CHEMISTRY LAB                | R23CC12L11  | BS&H      | 30             | 70             | 100         | 0 | 0 | 2 | 1           |
| 9            | COMMUNICATIVE ENGLISH LAB                | R23CC12L12  | BS&H      | 30             | 70             | 100         | 0 | 0 | 2 | 1           |
| 10           | HEALTH AND WELLNESS, YOGA AND SPORTS     | R23CC12MC1  | BS&H      | 100            | -              | 100         | - | - | 1 | 0.5         |
| <b>TOTAL</b> |  |             |           |                |                |             |   |   |   | <b>19.5</b> |

| I B.TECH<br>II-SEMESTER | L  | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|--|---|---|-------------------|-------------------|----------------|---------|
|                         | 3  | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE : R23CC1201        | DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS<br>(Common to all Engineering Branches) |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO 1: Solve** first order ordinary differential equations to real life situations.

**CO 2: Identify** and apply suitable methods in solving the higher order differential equations

**CO 3: Solve** the partial differentiation equations.

**CO 4: Interpret** the physical meaning of different operators as gradient, curl and divergence.

**CO 5: Estimate** the work done against a field, circulation and flux using vector calculus.

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

Linear differential equations - Bernoulli's equations - Exact equations and equations reducible to exact form - Applications: Newton's law of cooling - Law of natural growth and decay - Electrical circuits.

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

Definitions, homogenous and non-homogenous, complimentary function, particular integral, general solution - Wronskian, Method of variation of parameters - Simultaneous linear equations - Applications to L-C-R circuit problems and Simple harmonic motion.

**UNIT-III:****PARTIAL DIFFERENTIAL EQUATIONS**

Introduction and formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solutions of first order linear equations using Lagrange's method - Homogeneous and Non-homogeneous linear partial differential equations with constant coefficients.

**UNIT-IV:****VECTOR DIFFERENTIATION**

Scalar and vector point functions - Vector operator del - Del applied to scalar point functions - Gradient, Directional derivative - Del applied to vector point functions - Divergence and Curl - Solenoidal vector-Irrotational-scalar potential of vector - Vector identities.

**UNIT-V:****VECTOR INTEGRATION**

Line integral - Circulation - Work done - Surface integral, flux - Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Volume integral - Gauss divergence theorem (without proof) and related problems.

**TEXTBOOKS:**

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44<sup>th</sup> Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10<sup>th</sup> Edition.

**REFERENCE BOOKS:**

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14<sup>th</sup> Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5<sup>th</sup> Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5<sup>th</sup> Edition (9<sup>th</sup> reprint). Higher Engineering Mathematics, B. V. Ramana, Mc Graw Hill Education, 2017

| I B.Tech<br>II SEMESTER | L                     | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-----------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 2                     | 0 | 0 | 30                | 70                | 100            | 2       |
| CODE: R23CC1206         | COMMUNICATIVE ENGLISH |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1:** Summarize texts based on the comprehension of the material provided.

**CO2:** Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics

**CO3:** Use a diverse array of grammatical structures with flexibility, striving to minimize errors.

**CO4:** Use vocabulary adequately and appropriately to express and write on a variety of topics.

**UNIT I**

**Lesson: HUMAN VALUES: Gift of Magi (Short Story)**

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

**Grammar:** Parts of Speech, Basic Sentence Structures-forming questions

**Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

**UNIT II**

**Lesson: NATURE: The Brook by Alfred Tennyson (Poem)**

**Listening:** Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

**Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks.

**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Writing:** Structure of a paragraph - Paragraph writing (specific topics)

**Grammar:** Cohesive devices - linkers, use of articles and zero article; prepositions.

**Vocabulary:** Homonyms, Homophones, Homographs.

**UNIT III**

**Lesson: BIOGRAPHY: Elon Musk**

**Listening:** Listening for global comprehension and summarizing what is listened to.

**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed

**Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

**Writing:** Summarizing, Note-making, paraphrasing

**Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations

**Vocabulary:** Compound words, Collocations

#### UNIT IV

**Lesson: INSPIRATION: The Toys of Peace by Saki**

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

**Writing:** Letter Writing: Official Letters, Resumes

**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice

**Vocabulary:** Words often confused, Jargons

#### UNIT V

**Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)**

**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

**Speaking:** Formal oral presentations on topics from academic contexts

**Reading:** Reading comprehension.

**Writing:** Writing structured essays on specific topics.

**Grammar:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Vocabulary:** Technical Jargons

#### TEXTBOOKS:

1. Pathfinder: Communicative English for Undergraduate Students, 1<sup>st</sup> Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

#### REFERENCE BOOKS:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

| I B.TECH<br>II SEMESTER | L                     | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-----------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 3                     | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE :R23CC1208         | ENGINEERING CHEMISTRY |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To impart the concept of soft and hard waters, softening methods of hard water
- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry, polymers, cement and advanced engineering materials.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO1: Understand** the difference between soft and hard water and why it matters in daily life and industries.
- CO2: Apply** electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions
- CO3: Analyze** the production, properties, and environmental implications of polymers, fuels and biofuels.
- CO4: Apply** the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications.
- CO5: Apply** the Knowledge of various applications to synthesize colloids and characterize nano materials.

**UNIT I****WATER TECHNOLOGY**

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles – Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Ion-exchange process - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

**UNIT II****ELECTROCHEMISTRY AND APPLICATIONS**

Electrochemical cell, Reference electrodes: Metal-metal ion electrode (Calomel electrode) Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCd), Sodium –ion and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

**Corrosion:** Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling-Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electroless plating (Nickel and Copper)

**UNIT III****POLYMERS AND FUEL CHEMISTRY**

Introduction to polymers, Mechanism of chain growth, step growth polymerization. Plastics –Thermo plastics and Thermosetting plastics, Moulding Techniques-Compression moulding, injection moulding, Blow moulding, Elastomers – Preparation, properties and applications of Buna S, Buna N.



**Fuels** – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel

#### UNIT IV

##### MODERN ENGINEERING MATERIALS

**Composites**- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

**Refractories**- Classification, Properties, Factors affecting the refractory materials and Applications.

**Lubricants**- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.

**Building materials**- Portland cement, constituents, Setting and Hardening of cement.

#### UNIT V

##### SURFACE CHEMISTRY AND NANOMATERIALS

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (Braggs Method), stabilization of colloids by stabilizing agents.

**Nano materials:** Introduction–Sol-gel method & chemical reduction method of preparation – Characterization by BET method and TEM methods–Carbon nano tubes and fullerenes: Types–preparation–properties and applications.

##### TEXTBOOKS:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

##### REFERENCE BOOKS:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth- Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition.

| I B.TECH<br>II SEMESTER | L                     | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-----------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 3                     | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE: R23CC1209         | ENGINEERING MECHANICS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Learn and understanding the basic principles of mechanics of rigid bodies, various types of force systems and to analyze problems in a simple and logical manner.
- Study and calculate the concepts of wedge friction, and to analyze simple trusses using method of joints and method of sections.
- Study and determine centroids and centre of gravity of various standard geometrical shapes as well as composite areas and bodies.
- Learn the concept of moment of inertia and the mathematical calculations involved in finding moments of inertia of two dimensional areas.
- The students are to be exposed to concepts of work, energy and particle motion.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO 1:** Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle.

**CO 2:** Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges.

**CO 3:** Solve the centroid and centre of gravity bodies and composite sections.

**CO 4:** Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections.

**CO 5:** Apply the work-energy principle to particles and connected systems for engineering Applications.

**UNIT-I**

**INTRODUCTION TO ENGINEERING MECHANICS:** Basic Concepts, Scope and Applications, Characteristics of a Force, Force system, classification, Resultant of Force Systems, parallelogram law of forces, Triangle law of forces.

**SYSTEMS OF FORCES:** Resolution of forces, Coplanar Concurrent forces, Components in Space, Moment of Force and its Application–Couples, Varignon's theorem.

**EQUILIBRIUM OF SYSTEMS OF FORCES:** Equations of Equilibrium of Coplanar concurrent forces, Equations of Equilibrium for spatial system of forces using vector approach, Numerical Examples, Lami's Theorem, support reactions, free body diagrams.

**UNIT-II**

**ANALYSIS OF PLANE TRUSSES:** Definition, Assumptions made in the analysis of plane trusses-methods of joints and method of sections.

**FRICTION:** Introduction, Classification of friction, Laws of Friction, Coefficient of Friction, Angle of Friction, Angle of Repose, Motion of a body on an Inclined Plane, Cone of Static friction.

**UNIT-III**

**CENTROID:** Centroids of simple figures (from basic principles)-Centroids of composite figures.

**CENTRE OF GRAVITY:** Centre of Gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappu's theorem.

#### **UNIT-IV**

**AREA MOMENTS OF INERTIA:** Definition, Radius of gyration, Parallel axis theorem, perpendicular axis theorem, Moments of Inertia of composite figures, polar moment of Inertia.

**MASS MOMENT OF INERTIA:** Moment of Inertia of Rigid body-Moment of Inertia from basic principles-Slender bar, Rectangular Plate, Circular Plate, Moment of Inertia of 3D Bodies-Cone, Solid Cylinder.

#### **UNIT-V**

**RECTILINEAR AND CURVILINEAR MOTION OF A PARTICLE:** Kinematics and Kinetics - D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

**RIGID BODY MOTION:** Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method. Principle of Virtual work with simple Examples.

#### **TEXT BOOKS:**

1. Engineering Mechanics by S.Timoshenko & D.H.Young., 4th Edn - ,Mc Graw Hill publications.
2. Engineering Mechanics by S.S. Bhavikatti-New age publications
3. Engineering Mechanics Statics and Dynamics A.K.TAYAL Umesh publications.

#### **REFERENCE BOOKS:**

1. Engineering Mechanics by Fedinand . L. Singer, Harper –Collins.
2. Mechanics of Materials (In SI Units) by Beer and Johnson, Tata McGraw-Hil.
3. Strength of Materials (Mechanics of Materials) by James M.Gere and Barry J.Goodno, PWS-KENT Publishing Company, 1990
4. Strength of Materials (Mechanics of Solids) by R.K. Rajput, S.Chand Publications.

#### **Web References:**

1. <https://nptel.ac.in/courses/112103109/142>
2. <https://nptel.ac.in/courses/112103109/113>
3. <https://nptel.ac.in/courses/122104014/4>

#### **E-Books:**

1. <https://easyengineering.net/engineeringmechanicsbooks/>

| I B.TECH<br>I SEMESTER | L                                      | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|--|---|---|-------------------|-------------------|----------------|---------|
|                        | 3                                      | 0 | 0 | 30                | 70                | 100            | 3       |
| CODE: R23CC1212        | BASIC CIVIL AND MECHANICAL ENGINEERING |   |   |                   |                   |                |         |

## PART A: BASIC CIVIL ENGINEERING

### COURSE OBJECTIVES:

- To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
- To impart knowledge on applying appropriate theorem for electrical circuit analysis
- To explain transient behavior of circuits in time and frequency domains
- To teach concepts of resonance
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

### COURSE OUTCOMES:

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

**CO1: Acquire** knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

**CO2: Apply** the concepts of surveying to calculate distances, angles and levels.

**CO3: Realize** the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures.

### UNIT I

**Basics of Civil Engineering:** Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

### UNIT II

**Surveying:** Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

### UNIT III

**Transportation Engineering:** Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology-Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

### TEXTBOOKS:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

### REFERENCE BOOKS:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

## PART B: BASIC MECHANICAL ENGINEERING

### COURSE OBJECTIVES:

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

### COURSE OUTCOMES:

**After successful completion of this course, the students will be able to:**

- CO1: Illustrate** the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials.
- CO2: Explain** the basics of various manufacturing processes and thermal engineering and its applications.
- CO3: Describe** the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.

### UNIT I

**INTRODUCTION TO MECHANICAL ENGINEERING:** Role of Mechanical Engineering in Industries and Society - Mechanical Engineering Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace and Marine Engineering.

**ENGINEERING MATERIALS** – Basics of **Metals** (Ferrous & Non-ferrous), Ceramics, Composites, Smart materials.

### UNIT II

**MANUFACTURING PROCESSES:** Basics of - Principles of Casting, Forming and joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

**THERMAL ENGINEERING:** Basics of - working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

### UNIT III

**Power plants:** Basics of - Working principle of Steam, Diesel, Hydro, Nuclear power plants.

**Mechanical Power Transmission:** Basics of - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

**Introduction to Robotics:** Basics of - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

**TEXTBOOKS:**

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.
3. An introduction to Mechanical Engineering by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

**REFERENCE BOOKS:**

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

| I B.TECH<br>II SEMESTER | L                    | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|----------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                    | 0 | 3 | 30                | 70                | 100            | 1.5     |
| CODE: R23CC12L9         | ENGINEERING WORKSHOP |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**COURSE OUTCOMES:**

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

**CO1: Identify** workshop tools and their operational capabilities.

**CO2: Make** manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing.

**CO3: Apply** fitting operations in various applications.

**CO4: Apply** basic electrical engineering knowledge for House Wiring Practice.

**LIST OF EXPERIMENTS****ENGINEERING WORKSHOP TRADES FOR EXERCISE:**

- Demonstration:** Safety practices and precautions to be observed in workshop.
- Wood Working:** Familiarity with different types of woods and tools used in wood Working and make following joints.
  - Half – Lap joint
  - Dovetail joint
- Sheet Metal Working:** Familiarity with different types of tools used in sheet metal Working, Developments of following sheet metal job from GI sheets.
  - Conical funnel
  - Brazing
- Fitting:** Familiarity with different types of tools used in fitting and do the following Fitting exercises.
  - V-fit
  - Bicycle tire puncture
- Electrical Wiring:** Familiarity with different types of basic electrical circuits and make The following connections.
  - Parallel and Series
  - Tube light
- Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
- Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
- Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints With coupling for same diameter and with reducer for different diameters.
- Demonstration and basic repair works of two wheeler vehicle



| I B.TECH<br>II SEMESTER | L                         | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|---------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                         | 0 | 3 | 30                | 70                | 100            | 1.5     |
| CODE: R23ME12L7         | ENGINEERING MECHANICS LAB |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:** The students completing the course are expected to:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1 : Evaluate** the coefficient of friction between two different surfaces and the roller.

**CO2 : Apply** Law of Polygon of forces and Law of Moment using force polygon.

**CO3 : Determine** the Centre of gravity and Moment of Inertia of different configurations.

**CO4 : Solve** the equilibrium conditions of a rigid body under the action of different force systems.

### LIST OF EXPERIMENTS

*(Students have to perform any 10 of the following Experiments)*

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus.

**VIRTUAL LAB: ([www.vlabs.co.in](http://www.vlabs.co.in))**

1. Determine the Moment of Inertia of the compound pendulum – Symmetric  
(<https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=210&cnt=1>)
2. To determine the moment of inertia of a flywheel.  
(<https://vlab.amrita.edu/index.php?sub=1&brch=74&sim=571&cnt=1>)

**TEXTBOOKS:**

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. McGraw Hill Education 2017. 5th Edition.
2. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

| I B.TECH<br>II SEMESTER | L                         | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|---------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                         | 0 | 2 | 30                | 70                | 100            | 1       |
| CODE:<br>R23CC12L11     | ENGINEERING CHEMISTRY LAB |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Verify the fundamental concepts with experiments.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO 1: Develop** and perform analytical chemistry techniques to address the water related problems.

**CO 2: Determine** the strength of an acid, cell constant, potentials and conductance of solutions.

**CO 3: Prepare** advanced polymer Bakelite and nanomaterials.

**CO 4: Explain** the functioning of different analytical instruments.

**LIST OF EXPERIMENTS**

1. Determination of hardness of water sample by EDTA method
2. Determination of alkalinity of water sample
3. Estimation of Dissolved Oxygen by Winkler's method
4. Estimation of Ferrous Iron by Dichrometry
5. Determination of Strength of an acid in Pb-Acid battery
6. Estimation of Mg in Antacid
7. Estimation of Vitamin C
8. Preparation of a polymer (Bakelite)/urea formaldehyde resin.
9. Preparation of nanomaterials by precipitation method
10. Conductometric titration of strong acid vs. strong base
11. Conductometric titration of weak acid vs. strong base
12. Determination of cell constant and conductance of solutions
13. Potentiometry - determination of redox potentials and emfs
14. Verify Lambert-Beer's law
15. Wavelength measurement of sample through UV-Visible Spectroscopy

**Note: Any TEN of the listed experiments are to be conducted.**

**REFERENCE:**

1. "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

| I B.Tech<br>I SEMESTER | L   | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|------------------------|---|---|---|-------------------|-------------------|----------------|---------|
|                        | 0   | 0 | 2 | 30                | 70                | 100            | 1       |
| CODE : R23CC12L12      | COMMUNICATIVE ENGLISH LAB<br>(COMMON TO ALL BRANCHES) |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO 1:** Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning.
- CO 2:** Create a compelling resume, cover letter and Sop.
- CO 3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts.
- CO 4:** Apply employability skills to confidently navigate job interviews.

**LIST OF TOPICS:**

- Vowels & Consonants
- Neutralization/Accent Rules
- Communication Skills & JAM
- Role Play or Conversational Practice
- E-mail Writing
- Resume Writing, Cover letter, SOP
- Group Discussions-methods & practice
- Debates - Methods & Practice
- PPT Presentations/ Poster Presentation
- Interviews Skills

**SUGGESTED SOFTWARE:**

- Walden Infotech
- Young India Films

**REFERENCE BOOKS:**

- Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
- Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India,2016
- Hewing's, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2<sup>nd</sup> Ed),Kindle, 2013.

## WEB RESOURCES:

### Spoken English:

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://www.englishinteractive.net)
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. [https://www.youtube.com/c/mmmEnglish\\_Emma/featured](https://www.youtube.com/c/mmmEnglish_Emma/featured)
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. [https://www.youtube.com/channel/UCV1h\\_cBE0Drdx19qkTM0WNw](https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw)

### Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. [https://www.youtube.com/channel/UC\\_OskgZBoS4dAnVUgJVexc](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)  
[https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)

| <b>I B.TECH<br/>II SEMESTER</b> | <b>L</b>                                    | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|---------------------------------|---|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                 | 0   | 0        | 1        | 100                       | -                         | 100                    | 0.5            |
| <b>CODE: R23CC12MC1</b>         | <b>HEALTH AND WELLNESS, YOGA AND SPORTS</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVES:**

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO 1:** Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning.
- CO 2:** Create a compelling resume, cover letter and Sop.
- CO 3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts.
- CO 4:** Apply employability skills to confidently navigate job interviews.

**UNIT I**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

- Organizing health awareness programmes in community
- Preparation of health profile
- Preparation of chart for balance diet for all age groups

**UNIT II**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

**Activities:**

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

**Activities:**

- Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics.
- Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**REFERENCE BOOKS:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

**GENERAL GUIDELINES:**

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

**EVALUATION GUIDELINES:**

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

**II B.TECH - I SEMESTER**

| S. No        | Subject   | Course Code | Cat. Code | Internal Marks | External Marks | Total Marks | L         | T        | P         | Credits   |
|--------------|---|-------------|-----------|----------------|----------------|-------------|-----------|----------|-----------|-----------|
| 1            | Numerical Methods and Transform Techniques                            | R23CC2110   | BS        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 2            | Universal Human Values– Understanding Harmony & Ethical Human Conduct | R23CC2102   | HSMC      | 30             | 70             | 100         | 2         | 1        | 0         | 3         |
| 3            | Thermo dynamics   | R23ME2103   | ES        | 30             | 70             | 100         | 2         | 0        | 0         | 2         |
| 4            | Mechanics of Solids   | R23ME2104   | PC        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 5            | Material Science and Metallurgy                                       | R23ME2105   | PC        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 6            | Mechanics of Solids and Materials Science Lab                         | R23ME21L1   | PC        | 30             | 70             | 100         | 0         | 0        | 3         | 1.5       |
| 7            | Computer-aided Machine Drawing  | R23ME21L2   | PC        | 30             | 70             | 100         | 0         | 0        | 3         | 1.5       |
| 8            | Python programming Lab  | R23ME21L3   | ES        | 30             | 70             | 100         | 0         | 0        | 2         | 1.0       |
| 9            | Embedded Systems & IoT  | R23ME21L4   | SC        | 30             | 70             | 100         | 0         | 1        | 2         | 2         |
| 10           | Environmental Studies   | R23CC21MC   | MC        | 30             | 70             | 100         | 2         | 0        | 0         | -         |
| <b>Total</b> |   |             |           |                |                |             | <b>15</b> | <b>2</b> | <b>10</b> | <b>20</b> |



| <b>II B.TECH<br/>I SEMESTER</b> | <b>L</b>  | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|---------------------------------|---|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                 | 3   | 0        | 0        | 30                        | 70                        | 100                    | 3              |
| <b>Code: R23CC2110</b>          | <b>NUMERICAL METHODS AND TRANSFORM<br/>TECHNIQUES</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVES:**

- To elucidate the different numerical methods to solve nonlinear algebraic equations.
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO1: Evaluate** the approximate roots of polynomial and transcendental equations by different algorithms.
- CO2: Apply** numerical integral techniques to different Engineering problems. Apply different Algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations
- CO3: Apply** the Laplace transform for solving differential equations
- CO4: Analyze** the Fourier series of periodic signals
- CO5: Apply** integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms

**UNIT – I****ITERATIVE METHODS:**

Introduction of Solutions of algebraic and transcendental equations: Bisection method, Secant method, Method of false position, Iteration method, Newton-Raphson method (Simultaneous Equations).

Interpolation: Newton's forward and backward formulae for interpolation, Interpolation with unequal intervals, Lagrange's interpolation formula.

**UNIT – II****NUMERICAL INTEGRATION, SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS WITH INITIAL CONDITIONS:**

Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Solution of initial value problems by Taylor's series, Picard's method of successive approximations, Euler's method, Runge-Kutta method (second and fourth order), Milne's Predictor and Corrector Method.

**UNIT –III****LAPLACE TRANSFORMS:**

Definition of Laplace transform, Laplace transforms of standard functions, Properties of Laplace Transforms, Shifting theorems, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Inverse Laplace transforms, Convolution theorem (without proof).

**Applications:** Solving ordinary differential equations (initial value problems) and integral differential equations using Laplace transforms.

**UNIT – IV****FOURIER SERIES:**

Introduction– Periodic functions – Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half-range sine and cosine series.

## **UNIT – V**

### **FOURIER TRANSFORMS:**

Fourier integral theorem (without proof), Fourier sine and cosine integrals, Infinite Fourier transforms, Sine and cosine transforms, Properties, Inverse transforms, Convolution theorem (without proof), Finite Fourier transforms.

### **TEXT BOOKS:**

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill

### **REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press.

| II B.TECH<br>I SEMESTER | L   | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|---|---|---|-------------------|-------------------|----------------|---------|
|                         | 2   | 1 | 0 | 30                | 70                | 100            | 3       |
| Code: R23CC2102         | <b>UNIVERSAL HUMAN VALUES – UNDERSTANDING<br/>HARMONY &amp; ETHICAL HUMAN CONDUCT</b> |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

**COURSE OUTCOMES:**

**CO1: Interpret** the terms like Natural Acceptance, Happiness and Prosperity

**CO2: Identify** one's self, and one's surroundings (family, society nature)

**CO3: Apply** what they have learnt to their own self in different day-to-day settings in real life

**CO4: Relate** human values with human relationship and human society.

**CO5: Justify** the need for universal human values and harmonious existence

**CO6: Develop** as socially and ecologically responsible engineers

**COURSE TOPICS:**

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

**UNIT I**

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

**UNIT II**

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self  
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self  
Lecture 11: Harmony of the self with the body  
Lecture 12: Programme to ensure self-regulation and Health  
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

### **UNIT III**

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)  
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction  
Lecture 14: 'Trust' – the Foundational Value in Relationship  
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust  
Lecture 15: 'Respect' – as the Right Evaluation  
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect  
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship  
Lecture 17: Understanding Harmony in the Society  
Lecture 18: Vision for the Universal Human Order  
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

### **UNIT IV**

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)  
Lecture 19: Understanding Harmony in the Nature  
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature  
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature  
Lecture 21: Realizing Existence as Co-existence at All Levels  
Lecture 22: The Holistic Perception of Harmony in Existence  
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

### **UNIT V**

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)  
Lecture 23: Natural Acceptance of Human Values  
Lecture 24: Definitiveness of (Ethical) Human Conduct  
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct  
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order  
Lecture 26: Competence in Professional Ethics  
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education  
Lecture 27: Holistic Technologies, Production Systems and Management Models- Typical Case Studies  
Lecture 28: Strategies for Transition towards Value-based Life and Profession  
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

### **Practice Sessions for UNIT I – Introduction to Value Education**

PS1 Sharing about Oneself  
PS2 Exploring Human Consciousness  
PS3 Exploring Natural Acceptance

### **Practice Sessions for UNIT II – Harmony in the Human Being**

PS4 Exploring the difference of Needs of self and body  
PS5 Exploring Sources of Imagination in the self  
PS6 Exploring Harmony of self with the body

**Practice Sessions for UNIT III – Harmony in the Family and Society**

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

**Practice Sessions for UNIT IV – Harmony in the Nature (Existence)**

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

**Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics**

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

**READINGS:****Textbook and Teachers Manual****a. The Textbook**

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

**b. The Teacher's Manual**

R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2

**REFERENCE BOOKS**

1. Jeevan Vidya: E k Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karam chand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT:**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

### **ONLINE RESOURCES:**

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. [https://onlinecourses.swayam2.ac.in/aic22\\_ge23/preview](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)



| II B.TECH<br>I SEMESTER | L               | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-----------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 2               | 0 | 0 | 30                | 70                | 100            | 2       |
| Code: R23ME2103         | THERMO DYNAMICS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Provide fundamental concepts of Refrigeration and Psychrometry.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO1:** Explain the importance of thermodynamic properties related to conversion of heat energy into work.
- CO2:** Apply the Zeroth and First Law of Thermodynamics.
- CO3:** Analyze the Second Law of Thermodynamics.
- CO4:** Analyze Mollier charts, T-S and h-s diagrams, Phase Transformations, Dryness Fraction and Steam calorimetry.
- CO5:** Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.

**UNIT - I**

**Introduction:** Basic Concepts - System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility

**UNIT -II**

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law, First law for flow systems - Steady flow energy equation – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

**UNIT - III**

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, 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 - IV**

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. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

**UNIT – V**

**Introduction to Refrigeration:** working of Air, Vapor Compression, VCR system Components, COP Refrigerants.



**Introduction to Air Conditioning:** Psychrometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF.

Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning, and load calculations.

**TEXT BOOKS:**

1. P.K. Nag, Engineering Thermodynamics, 6/e, Tata McGraw Hill, 2017.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 10/e, Wiley, 2020.

**REFERENCE BOOKS:**

1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995.
2. Y.A. Cengel & M.A. Boles, Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
3. P. Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

**ONLINE LEARNING RESOURCES:**

- <https://www.edx.org/learn/thermodynamics>.
- <https://archive.nptel.ac.in/courses/112/106/112106310>.
- <https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s>
- [https://kp.kiit.ac.in/pdf\\_files/02/Study-Material\\_3rdSemester\\_Winter\\_2021\\_Mechanical-Engg.-Thermal-Engineering-1\\_Abhijit\\_Samant.pdf](https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rdSemester_Winter_2021_Mechanical-Engg.-Thermal-Engineering-1_Abhijit_Samant.pdf)
- <https://www.coursera.org/learn/thermodynamics-intro>

| II B.TECH<br>I SEMESTER | L                   | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|---------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 3                   | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2104         | MECHANICS OF SOLIDS |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

The objectives of the course are to

- Understand the behavior of basic structural members subjected to uni axial and bi axial loads.
- Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Students will learn all the methods to analyse beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- Design and analysis of Industrial components like pressure vessels.

**COURSE OUTCOMES:**

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

**CO1: Analyze** concepts of stress and strain, Elasticity and plasticity, Bars of varying section, composite bars, Temperature stresses, Principal planes and principal stresses, Mohr's circle.

**CO2: Analyze** beams and draw shear force diagrams and bending moment diagrams to the different loads for the different support arrangements.

**CO3: Determine** flexural stresses and shear stresses induced in the beams which are made with different cross sections like rectangular, circular, I and T sections.

**CO4: Evaluate** the equations of slope and deflection for beams by using double integration method, Macaulay's method, Mohr's theorem and Moment area method.

**CO5: Determine** stresses induced in thin and thick cylinders subjected to internal, external pressures for longitudinal and circumferential stresses.

**UNIT- I**

**SIMPLE STRESSES & STRAINS :** Elasticity and plasticity – Types of stresses & strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – 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, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure.

**UNIT-III**

**FLEXURAL STRESSES :** Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.

**SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

**UNIT-IV**

**DEFLECTION OF BEAMS :**Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

**TORSION:** Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

**UNIT- V**

**THIN AND THICK CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells. Lamé's equation – cylinders subjected to inside & outside pressures.

**COLUMNS:** Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

**TEXT BOOKS:**

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt. Ltd, New Delhi, 2018.

**REFERENCE BOOKS:**

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Publications, 1990.
5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

**ONLINE LEARNING RESOURCES:**

- [https://onlinecourses.nptel.ac.in/noc19\\_ce18/preview](https://onlinecourses.nptel.ac.in/noc19_ce18/preview).
- [https://youtube/iY\\_ypychVNY?si=310htc4ksTQJ8Fv6](https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6).
- [https://www.youtube.com/watch?v=WEy939Rkd\\_M&t=2s](https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s)
- <https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204>
- <https://www.coursera.org/learn/mechanics-1>
- <https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior>
- <https://archive.nptel.ac.in/courses/112/107/112107146/>

| II B.TECH<br>I SEMESTER | L                             | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-------------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 3                             | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2105         | MATERIAL SCIENCE & METALLURGY |   |   |                   |                   |                |         |

**COURSE OBJECTIVE:**

- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- Study the behavior of ferrous and nonferrous metals and alloys and their application in different domains
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Grasp the methods of making of metal powders and applications of powder metallurgy
- Comprehend the properties and applications of ceramic, composites and other advanced methods

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** the crystalline structure of different metals and study the stability of phases in different alloy systems.

**CO2: Identify** the behavior of ferrous and non-ferrous metals and alloys and their application in different domains.

**CO3: Analyze** the effect of heat treatment, addition of alloying elements on properties of ferrous metals.

**CO4: Analyze** the methods of making of metal powders and applications of powder metallurgy.

**CO5: Inspect** the properties and applications of ceramic, composites and other advanced methods.

**UNIT- I**

**STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS:** Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries– determination of grain size. Imperfections, Slip and Twinning. Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

**EQUILIBRIUM DIAGRAMS:** Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, Gibbs Phase rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe<sub>3</sub>C.

**UNIT-II**

**FERROUS METALS AND ALLOYS:** Structure and properties of White Cast iron, Malleable Cast iron, grey cast-iron, Spheroidal graphite cast-iron, Alloy cast-iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

**NON-FERROUS METALS AND ALLOYS:** Structure and properties of Copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

**UNIT-III**

**HEAT TREATMENT OF STEELS:** Effect of alloying elements on Fe-Fe<sub>3</sub>C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

**UNIT-IV**

**POWDER METALLURGY:** Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

**UNIT- V**

**CERAMIC AND ADVANCED MATERIALS:** Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nano materials and smart materials.

**TEXT BOOKS:**

1. S.H.Avner, Introduction to Physical Metallurgy, 3/e, Tata McGraw- Hill, 2017.
2. Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

**REFERENCE BOOKS:**

1. Dr. V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
3. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
6. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
7. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.

**ONLINE LEARNING RESOURCES:**

- <https://archive.nptel.ac.in/courses/113/106/113106032/>
- <https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior>.
- <https://www.youtube.com/watch?v=9Sf278j1GTU>
- <https://www.coursera.org/learn/fundamentals-of-materials-science>
- <https://www.coursera.org/learn/material-behavior>.

| II B.TECH<br>I SEMESTER | L  | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|--|---|---|-------------------|-------------------|----------------|---------|
|                         | 0  | 0 | 3 | 30                | 70                | 100            | 1.5     |
| Code: R23ME21L1         | <b>MECHANICS OF SOLIDS &amp; MATERIALS<br/>SCIENCE LAB</b> |   |   |                   |                   |                |         |

**COURSE OBJECTIVE:**

- Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test
- Conduct the torsion test to determine the modulus of rigidity of given specimen.
- Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
- Examine the stiffness of the open coil and closed coil spring and grade them.
- Analyze the microstructure and characteristics of ferrous and nonferrous alloy specimens.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** the stress, strain behavior of different materials.

**CO2: Evaluate** the hardness of different materials.

**CO3: Compare** the relation between elastic constants and hardness of materials.

**CO4: Identify** various microstructures of steels and cast irons.

**CO5: Evaluate** hardness of treated and untreated steels.

**NOTE: Any 6 experiments from each section A and B.**

**A) MECHANICS OF SOLIDS LAB:**

1. Tensile test
2. Bending test on
  - a) Simply supported beam
  - b) Cantilever beam
3. Torsion test
4. Hardness test
  - a) Brinell's hardness test
  - b) Rockwell hardness test
  - c) Vickers hardness test
5. Test on springs
6. Impact test
  - a) Charpy test
  - b) Izod test
7. Magnetic Particle Testing
8. Liquid penetration test

**B) MATERIAL SCIENCE LAB:**

1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Study of the Microstructures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.

**VIRTUAL LAB:**

1. To investigate the principal stresses  $\sigma_a$  and  $\sigma_b$  at any given point of a structural element or machine component when it is in a state of plane stress.  
(<https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html>)
2. To find the impact resistance of mild steel and cast iron.  
(<https://sm-nitk.vlabs.ac.in/exp/izod-impact-test>).
3. To find the impact resistance of mild steel.  
(<https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html>)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc.  
(<https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test>)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine.  
(<https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test>).



| II B.TECH<br>I SEMESTER | L                              | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|--------------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                              | 0 | 3 | 30                | 70                | 100            | 1.5     |
| Code: R23ME21L2         | COMPUTER-AIDED MACHINE DRAWING |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings and Familiarize with limits, fits, and tolerances in mating components

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Utilize** the conventional representations of materials and machine components.

**CO2: Model** the riveted, welded and key joints using CAD system.

**CO3: Model** the solid models and sectional views of machine components by using 3D software package.

**CO4: Model** the solid models of machine parts and assemble them by using 3D software package.

**CO5: Analyze** the limits, fits and tolerances for mating parts and prepare manufacturing drawing

**THE FOLLOWING ARE TO BE DONE BY ANY 2D SOFTWARE PACKAGE****Conventional representation of materials and components:****Detachable joints:**

Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

**Riveted joints:**

Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

**Welded joints:**

Lap joint and T joint with fillet, butt joint with conventions.

**Keys:**

Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

**Couplings:**

Rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's coupling.

**THE FOLLOWING EXERCISES ARE TO BE DONE BY ANY 3D SOFTWARE PACKAGE:****Sectional views:**

Creating solid models of complex machine parts and sectional views.

**Assembly drawings : (Any four of the following using solid model software)**

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, and universal coupling.

**Production drawing:**

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

**TEXT BOOKS:**

1. Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014
2. Machine drawing by N.Sideswar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.

**REFERENCE BOOKS:**

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

**ONLINE LEARNING RESOURCES:**

- <https://eedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf>
- <https://archive.nptel.ac.in/courses/112/105/112105294/>
- [https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked\\_from=autocomplete&c=autocomplete](https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete)
- [https://www.youtube.com/watch?v=0bQkS3\\_3Fq4](https://www.youtube.com/watch?v=0bQkS3_3Fq4)

| II B.TECH<br>I SEMESTER | L                      | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                      | 0 | 2 | 30                | 70                | 100            | 1.0     |
| Code: R23ME21L3         | PYTHON PROGRAMMING LAB |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- Fundamental Understanding: Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.
- Data Manipulation: Equip students with skills to handle and manipulate data using Python libraries like Pandas and NumPy.
- Problem-Solving: Enhance problem-solving abilities by implementing various algorithms and data structures in Python.
- Software Development: Foster software development skills, including version control, package management, and project documentation.
- Advanced Techniques: Introduce advanced Python topics such as web scraping, API interaction, and database management.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Develop** a solid foundation in Python programming, covering essential syntax, semantics, and constructs.

**CO2: Analyze** data using Python libraries like Pandas and NumPy.

**CO3: Develop** various algorithms and data structures in Python.

**CO4: Develop** skills, including version control, package management, and project documentation.

**CO5: Analyze** web scraping, API interaction, and database management.

**Experiment 1: Introduction to Python**

**Objective:** Install Python and set up the development environment.

**Tasks:**

- Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).
- Write and run a simple "Hello, World!" program.
- Understand and demonstrate basic Python syntax and semantics.

**Experiment 2: Basic Python Programming**

**Objective:** Learn basic programming constructs in Python.

**Tasks:**

- Create programs using variables, data types, and operators.
- Implement basic input and output functions.
- Write programs using control structures (if statements, for loops, while loops).

**Experiment 3: Functions and Modules**

**Objective:** Understand functions and module usage in Python.

**Tasks:**

- Define and call functions with different types of arguments and return values.
- Explore and use built-in Python modules.
- Write a script that imports and utilizes at least two different standard library modules.

**Experiment 4: Lists and Tuples**

**Objective:** Work with Python lists and tuples.

**Tasks:**

- Create, modify, and iterate over lists and tuples.
- Perform list comprehensions to create new lists.
- Demonstrate the immutability of tuples.

**Experiment 5: Dictionaries and Sets**

**Objective:** Explore dictionaries and sets in Python.

**Tasks:**

- Create and manipulate dictionaries.
- Use dictionary comprehension.
- Create and perform operations on sets.

**Experiment 6: Strings and File I/O**

**Objective:** Manipulate strings and perform file I/O operations.

**Tasks:**

- Demonstrate various string methods.
- Write programs to read from and write to text files.
- Work with different file formats, including CSV and JSON.

**Experiment 7: Error Handling and Exceptions**

**Objective:** Implement error handling in Python programs.

**Tasks:**

- Write programs using try, except, else, and finally blocks.
- Handle specific exceptions.
- Create and raise custom exceptions.

**Experiment 8: Object-Oriented Programming (OOP)**

**Objective:** Understand and implement OOP concepts in Python.

**Tasks:**

- Define classes and create objects.
- Demonstrate inheritance and polymorphism.
- Use class and instance variables in programs.

**Experiment 9: Libraries and Packages**

**Objective:** Utilize third-party libraries and create Python packages.

**Tasks:**

- Install and use libraries like NumPy and Pandas.
- Create a simple Python package and distribute it.
- Work with virtual environments to manage dependencies.

**Experiment 10: Working with Data**

**Objective:** Perform data manipulation and visualization.

**Tasks:**

- Use Pandas to load, manipulate, and analyze datasets.
- Create visualizations using Matplotlib and Seaborn.
- Conduct basic data analysis tasks and summarize findings.

**Experiment 11: Web Scraping and APIs**

**Objective:** Extract data from the web and interact with APIs.

**Tasks:**

- Access and parse data from RESTful APIs.
- Process and analyze JSON data from APIs.

**Experiment 12: Databases****Objective:** Work with databases in Python.**Tasks:**

- Connect to a database using SQLite and SQLAlchemy.
- Perform CRUD operations on the database.
- Write queries to manage and retrieve data.

**TEXT BOOKS:**

1. Kenneth Lambert, “Fundamentals of Python: First Programs”.
2. Allen B. Downey, “think python: how to think like a computer scientist”, 2nd edition, O’reilly, 2016

**REFERENCE BOOKS:**

1. Python programming: A modern approach, vamsi kurama, pearson.
2. Learning python, Mark Lutz, Orielly.
3. Core python programming, W.Chun, pearson.
4. Introduction to python, Kenneth A. Lambert, Cengage.

**ONLINE LEARNING RESOURCES:**

1. [https://www.udemy.com/course/python-the-complete-python-developercourse/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm\\_campaign=BGPython\\_v.PROF\\_la.EN\\_cc.INDIA\\_ti.7380&utm\\_content=deal4584&utm\\_medium=udemyads&utm\\_source=bing&utm\\_term=.\\_ag\\_1220458320107116\\_.ad\\_.kw\\_Python+language\\_.de\\_c\\_.dm\\_.pl\\_.ti\\_kwd-76278984197882%3Aloc90\\_.li\\_116074\\_.pd\\_.&couponCode=IND21PM](https://www.udemy.com/course/python-the-complete-python-developercourse/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BGPython_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=._ag_1220458320107116_.ad_.kw_Python+language_.de_c_.dm_.pl_.ti_kwd-76278984197882%3Aloc90_.li_116074_.pd_.&couponCode=IND21PM)
2. [https://www.w3schools.com/python/python\\_intro.asp](https://www.w3schools.com/python/python_intro.asp)
3. <https://www.youtube.com/watch?v=eWRfhZUzrAc>
4. [https://onlinecourses.nptel.ac.in/noc20\\_cs83/preview](https://onlinecourses.nptel.ac.in/noc20_cs83/preview)
5. <https://www.edx.org/learn/python>
6. Virtual Labs - <https://python-iitk.vlabs.ac.in/>
7. Virtual Labs - <https://virtual-labs.github.io/exp-arithmetic-operations-iitk/>
8. Virtual Labs - <https://cse02-iiith.vlabs.ac.in/>
9. [https://mlritm.ac.in/assets/cse/cse\\_lab\\_manuals/R20\\_cse\\_manuals/Python%20Lab%20Manual.pdf](https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf)

| II B.TECH<br>I SEMESTER | L                      | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|------------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 0                      | 1 | 2 | 30                | 70                | 100            | 2       |
| Code: R23ME21L4         | EMBEDDED SYSTEMS & IOT |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

**COURSE OUTCOMES:**

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

**CO1: Comprehend** Microcontroller-Transducers Interface techniques.

**CO2: Establish** Serial Communication link with Arduino

**CO3: Analyze** basics of SPI interface.

**CO4: Analyze** the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.

**CO5: Analyze** the revolution of internet in mobile devices, cloud and sensor networks

**EMBEDDED SYSTEMS EXPERIMENTS**

(Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper Terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

**COMPONENTS/ BOARDS:** 1. Arduino Duemilanove Board  
2. Arduino Software IDE.

**TEXT BOOKS:**

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

**INTERNET OF THINGS EXPERIMENTS****(Any 5 experiments from the following)**

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
4. Raspberry Pi interact with online services through the use of public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.
6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi
7. Calculate the distance using distance sensor Using Arduino.
8. Basic LED functionality Using Arduino.
9. Calculate temperature using temperature sensor Using Arduino.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

**TEXT BOOKS:**

1. Arsheep Bahga & Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

**ONLINE LEARNING SOURCES**

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc21_cs17/preview)
2. [https://onlinecourses.nptel.ac.in/noc20\\_ee98/preview](https://onlinecourses.nptel.ac.in/noc20_ee98/preview)
3. <https://archive.nptel.ac.in/courses/108/105/108105057/>
4. [https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product\\_category=course&placement\\_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems](https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems)
5. [https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked\\_from=autocomplete&c=autocomplete](https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete)
6. [https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results\\_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product\\_category=course&placement\\_url=https%3A%2F%2Fwww.edx.org%2Fsearch](https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch)
7. Virtual Labs - <http://vlabs.iitkgp.ac.in/rtes/>
8. Virtual Labs - <https://cse02-iiith.vlabs.ac.in/>
9. Virtual Labs - <https://iotvirtuallab.github.io/vlab/Experiments/index.html>



| II B.TECH<br>I SEMESTER | L                     | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|-------------------------|-----------------------|---|---|-------------------|-------------------|----------------|---------|
|                         | 2                     | 0 | 0 | 30                | 70                | 100            | -       |
| Code: R23CC21MC         | ENVIRONMENTAL STUDIES |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.

**CO2: Explain** the concepts of the ecosystem, need, biodiversity and its functions.

**CO3: Distinguish** various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management

**CO4: Analyze** the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

**CO5: Illustrate** the causes of population explosion, value education and welfare programmes.

**UNIT – I**

**Multidisciplinary Nature of Environmental Studies:** – Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

**UNIT – II**

**Ecosystems:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- Forest ecosystem.
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biodiversity and Its Conservation :** Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT – III**

**Environmental Pollution:** Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution

**Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**UNIT – IV**

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**UNIT – V**

**Human Population And The Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**TEXTBOOKS:**

1. ErachBharucha, Text book of EnvironmentalStudiesfor Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

**REFERENCE BOOKS:**

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

**ONLINE LEARNING RESOURCES:**

- [https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)
- [https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product\\_category=course&placement\\_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science](https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science)
- <http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf>
- <https://www.youtube.com/watch?v=5QxxaVfgQ3k>

**II B.TECH - II SEMESTER**

| S. No   | Subject                                       | Course Code | Cat. Code | Internal Marks | External Marks | Total Marks | L         | T        | P         | Credits   |
|---|---|-------------|-----------|----------------|----------------|-------------|-----------|----------|-----------|-----------|
| 1   | Industrial Management                         | R23ME2201   | HS        | 30             | 70             | 100         | 2         | 0        | 0         | 2         |
| 2   | Complex Variables, Probability and Statistics | R23ME2202   | BS        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 3   | Manufacturing processes                       | R23ME2203   | PC        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 4   | Fluid Mechanics & Hydraulic Machines          | R23ME2204   | PC        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 5   | Theory of Machines                            | R23ME2205   | PC        | 30             | 70             | 100         | 3         | 0        | 0         | 3         |
| 6   | Fluid Mechanics & Hydraulic Machines Lab      | R23ME22L1   | PC        | 30             | 70             | 100         | 0         | 0        | 3         | 1.5       |
| 7   | Manufacturing processes Lab                   | R23ME22L2   | PC        | 30             | 70             | 100         | 0         | 0        | 3         | 1.5       |
| 8   | Soft Skills                                   | R23ME22L4   | SC        | 30             | 70             | 100         | 0         | 1        | 2         | 2         |
| 9   | Design Thinking & Innovation                  | R23CC22L3   | ES        | 30             | 70             | 100         | 1         | 0        | 2         | 2         |
| <b>Total</b>  |   |             |           |                |                |             | <b>15</b> | <b>1</b> | <b>10</b> | <b>20</b> |
| <b>Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation</b> |   |             |           |                |                |             |           |          |           |           |

| II B.TECH<br>II SEMESTER | L                     | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|-----------------------|---|---|-------------------|-------------------|----------------|---------|
|                          | 2                     | 0 | 0 | 30                | 70                | 100            | 2       |
| Code: R23ME2201          | INDUSTRIAL MANAGEMENT |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

The objectives of the course are to

- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

**COURSE OUTCOMES:**

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

**CO1: Explain** about how to design the optimal layout

**CO2: Demonstrate** work study methods

**CO3: Explain** Quality Control techniques

**CO4: Discuss** the financial management aspects and

**CO5: Interpret** the human resource management methods.

**UNIT– I**

**INTRODUCTION:** Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

**PLANT LAYOUT:** Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and break down maintenance.

**UNIT–II**

**WORK STUDY:** Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

**UNIT–III**

**STATISTICAL QUALITY CONTROL:** Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – X and R –charts X and S charts and their applications, numerical examples.

**TOTAL QUALITY MANAGEMENT:** zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts

**UNIT– IV**

**FINANCIAL MANAGEMENT:** Scope and nature of financial management, Sources of finance, Concept of Capital, Working Capital cycle, Fixed Capital V/s Working Capital, Management of working capital, estimation of working capital requirements, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

**UNIT-V**

**HUMAN RESOURCE MANAGEMENT:** Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job- evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types.

**VALUE ANALYSIS:** Value engineering, implementation procedure, enterprise resource planning and supply chain management.

**TEXT BOOKS:**

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand&Company Ltd. NewDelhi, 2006.

**REFERENCE BOOKS:**

1. Bhattacharya DK, Industrial Management,S.Chand, publishers, 2010.
2. J.G Monks, Operations Management,3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008.
4. KoontzO' Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C. Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management,1/e, Cengage India Private Limited, 2013.

**ONLINE LEARNING SOURCES**

- [https://onlinecourses.nptel.ac.in/noc21\\_me15/preview](https://onlinecourses.nptel.ac.in/noc21_me15/preview)
- [https://onlinecourses.nptel.ac.in/noc20\\_mg43/preview](https://onlinecourses.nptel.ac.in/noc20_mg43/preview)
- <https://www.edx.org/learn/industrial-engineering>
- <https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi>
- [https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX\\_5RG69hS3v2ll](https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll)

| II B.TECH<br>II SEMESTER | L  | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|--|---|---|-------------------|-------------------|----------------|---------|
|                          | 3  | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2202          | <b>COMPLEX VARIABLES, PROBABILITY AND STATISTICS</b> |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1:Apply** Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic.

**CO2:Make use of** the Cauchy residue theorem to evaluate certain integrals.

**CO3:Infer** the statistical inferential methods based on small and large sampling tests.

**CO4:Solve** the differentiation and integration of complex functions used in engineering problems.

**CO5:Design** the components of a classical hypothesis test.

**UNIT – I:****Functions of a complex variable and Complex integration:**

Introduction, Continuity, Differentiability, Analyticity, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic and conjugate harmonic functions, Milne–Thompson method. Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, generalized integral formula (all without proofs) and problems on above theorems.

**UNIT – II:****Series expansions and Residue Theorem:**

Radius of convergence, Expansion of function in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated, Essential singularities, Pole of order m, Residues, Residue theorem (without proof), Evaluation of real integral of the types

$$\int_{-\infty}^{\infty} f(x)dx \text{ and } \int_C^{c+2\pi} f(\cos\theta, \sin\theta)d\theta.$$

**UNIT – III:****Probability and Distributions:**

Review of probability and Baye's theorem, Random variables, Discrete and Continuous random variables. Distribution functions: Probability mass function, Probability density function and Cumulative distribution functions, Mathematical Expectation and Variance, Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV:****Sampling Theory:**

Introduction, Population and Samples, Sampling distribution of Means and Variance (definition only), Point and Interval estimations, Maximum error of estimate, Central limit theorem (without proof), Estimation using t- test.



**UNIT – V:****Tests of Hypothesis:**

Introduction of Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors , Level of significance, One tail and two-tail tests.

Test of significance for large samples and Small Samples: Single and difference means, Single and two proportions, Student's t- test, F-test,  $\chi^2$ -test.

**TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers.
2. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

**REFERENCE BOOKS:**

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9/e, Mc-Graw Hill, 2013.
2. S.C.Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand&Sons Publications, 2012.
3. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8/e, Cengage publishers.
4. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8/e, Pearson publishers, 2007.
5. Sheldon, M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4/e, Academic Foundation, 2011.

| II B.TECH<br>II SEMESTER | L                       | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|-------------------------|---|---|-------------------|-------------------|----------------|---------|
|                          | 3                       | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2203          | MANUFACTURING PROCESSES |   |   |                   |                   |                |         |

**COURSE OBJECTIVE:** The objectives of the course are to

- Know the working principle of different metal casting processes and gating system.
- Classify the welding processes, working of different types of welding processes and welding defects.
- Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Understand the principles of forging, tools and dies, working of forging processes.
- Know about the Additive manufacturing.

### COURSE OUTCOMES:

**After successful completion of this course, the students will be able to:**

**CO1: Design** the patterns and core boxes for metal casting processes

**CO2: Inspect** the different welding processes

**CO3: Analyze** the different types of bulk forming processes

**CO4: Analyze** sheet metal forming processes

**CO5: Distinguish** about the different types of additive manufacturing processes

### UNIT– I

**CASTING:** Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

### UNIT–II

**WELDING:** Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG & MIG welding. Electro-slag welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. Heat affected zones in welding; pre & post heating, welding defects –causes and remedies.

### UNIT–III

**BULK FORMING:** Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

### UNIT– IV

**SHEET METAL FORMING:** Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, spring back and its remedies, Coining, Spinning, Types of presses and press tools.

**HIGH ENERGY RATE FORMING PROCESSES:** Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

#### **UNIT -V**

**ADDITIVE MANUFACTURING:** Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photo polymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications. Basics of Coatings and Semiconductor manufacturing Processes.

#### **TEXT BOOKS:**

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

#### **REFERENCE BOOKS:**

1. A.Ghosh & A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman, Workshop Technology, 5/e, CBS Publishers & Distributors Pvt. Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.
8. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer, 2015.

#### **ONLINE LEARNING RESOURCES:**

- <https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes>
- [https://onlinecourses.nptel.ac.in/noc21\\_me81/preview](https://onlinecourses.nptel.ac.in/noc21_me81/preview)
- [www.coursera.org/learn/introduction-to-additive-manufacturing-processessera](http://www.coursera.org/learn/introduction-to-additive-manufacturing-processessera)
- <https://archive.nptel.ac.in/courses/112/103/112103263/>
- <https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed>

| II B.TECH<br>II SEMESTER | L                                    | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|--------------------------------------|---|---|-------------------|-------------------|----------------|---------|
|                          | 3                                    | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2204          | FLUID MECHANICS & HYDRAULIC MACHINES |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:** The students completing this course are expected to

- Understand the properties of fluids, manometry, hydrostatic forces acting on different surfaces
- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.
- Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** the basic concepts of fluid properties and Calculation of metacenter height. Stability analysis and applications

**CO2: Estimate** the mechanics of fluids in static and dynamic conditions.

**CO3: Apply** the Boundary layer theory, flow separation and dimensional analysis.

**CO4: Estimate** the hydro dynamic forces of jet on vanes indifferent positions.

**CO5: Evaluate** the performance of hydraulic pumps and turbines.

#### UNIT-I

**FLUID STATICS:** Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

**BUOYANCY AND FLOATATION:** Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

#### UNIT-II

**FLUID KINEMATICS:** Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for ir rotational flow, flow net, source and sink, doublet and vortex flow.

**FLUID DYNAMICS:** surface and body forces –Euler's and Bernoulli's equations for flow along a streamline, momentum equation and its applications, force on pipe bend.

**CLOSED CONDUIT FLOW:** Reynolds's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel total energy line hydraulic gradient line.

#### UNIT-III

**BOUNDARY LAYER THEORY:** Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

**DIMENSIONAL ANALYSIS:** Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

#### 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, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube-theory-functions and efficiency.

#### **UNIT V**

**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. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Advantages, limitations and applications.

**CENTRIFUGAL PUMPS:** classification, working, work done – manometric head- losses and efficiencies-specific speed-performance characteristic curves, cavitation & NPSH.

**RECIPROCATING PUMPS:** Working, Discharge, slip, indicator diagrams.

#### **TEXT BOOKS:**

1. Y.A. Cengel, J.M.Cimbala, Fluid Mechanics, Fundamentals and Applications, 6/e, McGraw Hill Publications, 2019.
2. Dixon, Fluid Mechanics and Thermodynamics of Turbo machinery, 7/e, Elsevier Publishers, 2014.

#### **REFERENCE BOOKS:**

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RK Bansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications (P)Ltd, 2019.
3. Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016.
4. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria & Sons, 2013.
5. D. Rama Durgaiah, Fluid Mechanics and Machinery, 1/e, New Age International, 2002.

#### **ONLINE LEARNING RESOURCES:**

- <https://archive.nptel.ac.in/courses/112/105/112105206/>
- <https://archive.nptel.ac.in/courses/112/104/112104118/>
- <https://www.edx.org/learn/fluid-mechanics>
- [https://onlinecourses.nptel.ac.in/noc20\\_ce30/previewnptel.ac.in](https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in)
- [www.coursera.org/learn/fluid-powerera](http://www.coursera.org/learn/fluid-powerera)

| II B.TECH<br>II SEMESTER | L                  | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|--------------------|---|---|-------------------|-------------------|----------------|---------|
|                          | 3                  | 0 | 0 | 30                | 70                | 100            | 3       |
| Code: R23ME2205          | THEORY OF MACHINES |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:** The objectives of the course are to make the students learn about

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Analyze** different mechanisms and inversions of four bar chain and slider crank chains.

**CO2: Evaluate** displacement, velocity and acceleration of different links in a mechanism.

**CO3: Apply** effects of gyroscopic couple in ships, aero planes and road vehicles and **Evaluate** the unbalanced mass in rotating machines using analytical and graphical methods.

**CO4: Design** different types of Cam and Gear Profiles.

**CO5: Analyze** free and forced vibrations of single degree freedom systems.

**UNIT – I:**

**SIMPLE MECHANISMS:** Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, Grubler's Criteria, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – Universal Joint.

**UNIT – II:**

**PLANE AND MOTION ANALYSIS:** Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis – kinematic analysis of simple mechanisms – slider crank mechanism dynamics.

**UNIT – III:**

**GYROSCOPE:** Principle of gyroscope, gyroscopic effect in an aero plane, ship, car and two wheeler, simple problems.

**BALANCING OF ROTATING MASSES:** Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

**UNIT – IV:**

**CAMS:** Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions- specified contour cams- circular and tangent cams –pressure angle and undercutting.

**GEAR PROFILE:** Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

**UNIT – V:**

**VIBRATIONS:** Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations without damping in single degree of freedom; Vibration isolation and transmissibility.

**TURNING MOMENT DIAGRAMS:** Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed.

**TEXT BOOKS:**

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

**REFERENCE BOOKS:**

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E. Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K. Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.



| <b>II B.TECH<br/>II SEMESTER</b> | <b>L</b>  | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|----------------------------------|---|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                  | 0   | 0        | 3        | 30                        | 70                        | 100                    | 1.5            |
| <b>Code: R23ME22L1</b>           | <b>FLUID MECHANICS &amp; HYDRAULIC MACHINES<br/>LAB</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVE:**

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

- CO1: Measure** the Impact of jets on Vanes
- CO2: Evaluate** the operating parameters of turbines.
- CO3: Evaluate** the operating parameters of pumps.
- CO4: Determine** the friction factor and major losses in pipes.
- CO5: Measure** the flow rate in Venturimeter, Orificemeter and Turbine Flow Meter

**LIST OF EXPERIMENTS**

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

**VIRTUAL LAB:**

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow.  
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/Reynolds/introduction.html>)
2. To calculate Total Energy at different points of venture meter.  
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html>).
3. To calculate the flow (or point) velocity at center of the given tube using different flow rates.  
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html>)
4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition. (<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html>).
5. To determine the discharge coefficient of a triangular notch.  
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html>)
6. To determine the coefficient of impact of jet on vanes.  
(<https://fm-nitk.vlabs.ac.in/exp/impact-of-jet>).
7. To determine friction in pipes. (<https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html>).

| <b>II B.TECH<br/>II SEMESTER</b> | <b>L</b>                           | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|----------------------------------|------------------------------------|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                  | 0                                  | 0        | 3        | 30                        | 70                        | 100                    | 1.5            |
| <b>Code: R23ME22L2</b>           | <b>MANUFACTURING PROCESSES LAB</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVE:**

Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Make** moulds for sand casting.

**CO2: Make** different types of components using various manufacturing techniques.

**CO3: Analyze** unconventional manufacturing methods.

**CO4: Develop** Different Weld joints.

**CO5: Analyze** different types of 3D Printing techniques.

**LIST OF EXPERIMENTS**

1. Design and making of pattern
  - i. Single piece pattern
  - ii. Split pattern
2. Sand properties testing
  - i. Sieve analysis(dry sand)
  - ii. Clay content test
  - iii. Moisture content test
  - iv. Strength test(Compression test & Shear test)
  - v. Permeability test
3. Mould preparation
  - i. Straight pipe
  - ii. Bent pipe
  - iii. Dumble
  - iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
  - i. Lap joint
  - ii. Butt joint
6. Injection Moulding
7. Blow Moulding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. To make weldments using TIG/MIG welding
11. To weld using Spot welding machine
12. To join using Brazing and Soldering
13. To make simple parts on a 3D printing machine
14. Demonstration of metal casting.

**VIRTUAL LAB:**

1. To study and observe various stages of casting through demonstration of casting process.  
(<https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html>)
2. To weld and cut metals using an oxyacetylene welding setup.  
(<https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html>).
3. To simulate Fused deposition modelling process (FDM)  
(<https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process>)
4. <https://altair.com/inspire-mold/>
5. <https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html>

| <b>II B.TECH<br/>II SEMESTER</b> | <b>L</b>           | <b>T</b> | <b>P</b> | <b>INTERNAL<br/>MARKS</b> | <b>EXTERNAL<br/>MARKS</b> | <b>TOTAL<br/>MARKS</b> | <b>CREDITS</b> |
|----------------------------------|--------------------|----------|----------|---------------------------|---------------------------|------------------------|----------------|
|                                  | 0                  | 1        | 2        | 30                        | 70                        | 100                    | 2              |
| <b>Code: R23ME22L4</b>           | <b>SOFT SKILLS</b> |          |          |                           |                           |                        |                |

**COURSE OBJECTIVES:**

- To prepare for global competition in employment and achieve professional excellence.
- To help students develop interpersonal and intrapersonal skills, enabling them to lead meaningful professional lives.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Grasp** the meaning and importance of soft skills and learn how to develop them.

**CO2: Comprehend** the significance of soft skills in the working environment for professional excellence.

**CO3: Prepare** to undergo the placement process with confidence and clarity.

**CO4: Interpret** any situation in life and equip themselves to handle them effectively.

**CO5: Interpret** the importance of etiquette in both professional and personal life.

**UNIT – 1:****INTRODUCTION**

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, English - Improving Techniques.

**UNIT – II:****INTRA-PERSONAL:**

Definition-Meaning – Importance-SWOT analysis, Johari windows - Goal Setting- skills quotient - Emotional Intelligence- Attitudinal skills - positive thinking- Problem Solving-Time management, stress management.

**UNIT – III:****INTER-PERSONAL:**

Definition – Meaning – Importance-Communications skills- Team Work, managerial skills -Negotiation skills- Leadership skills, corporate etiquettes.

**UNIT – IV:****VERBAL SKILLS:**

Definition and Meaning-Listening skills, need- types, advantages, Importance- Tips for Improving Listening, Speaking, need- types, advantages, Importance- Tips for Improving Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance.

**UNIT – V:****NON VERBAL SKILLS& INTERVIEW SKILLS**

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics - Posture, body language in cross cultural context , body language in interview room, appearance and dress code – Kinetics- Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

**TEXT BOOKS:**

1. Sherfield, M. Robert et al, Cornerstone Developing Soft Skills, 4/e, Pearson Publication, New Delhi, 2014.
2. Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

**REFERENCE BOOKS:**

1. Sambaiah.M. Technical English, Wiley publishers India. New Delhi. 2014.
2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.
3. Alex.K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4. Meenakshi Raman and Sangita Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.
5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S. Chand Publication, New Delhi, 2014.
6. Stephen Covey, Seven Habits of Highly Effective People, JMD Book, 2013.

**ONLINE LEARNING RESOURCES:**

- [https://onlinecourses.nptel.ac.in/noc20\\_hs60/preview](https://onlinecourses.nptel.ac.in/noc20_hs60/preview)
- <http://www.youtube.com/@softskillsdevelopment6210>
- [https://youtube.com/playlist?list=PLLy\\_2iUCG87CQhELCytvXh0E\\_y-bOO1\\_q&si=Fs05Xh8ZrOPsR8F4](https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q&si=Fs05Xh8ZrOPsR8F4)
- <https://www.coursera.org/learn/people-soft-skills-assessment?language=English>
- <https://www.edx.org/learn/soft-skills>

| II B.TECH<br>II SEMESTER | L                            | T | P | INTERNAL<br>MARKS | EXTERNAL<br>MARKS | TOTAL<br>MARKS | CREDITS |
|--------------------------|------------------------------|---|---|-------------------|-------------------|----------------|---------|
|                          | 0                            | 1 | 2 | 30                | 70                | 100            | 2       |
| Code: R23CC22L3          | DESIGN THINKING & INNOVATION |   |   |                   |                   |                |         |

**COURSE OBJECTIVES:**

The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

**COURSE OUTCOMES:**

**After successful completion of this course, the students will be able to:**

**CO1: Explain** the concepts related to design thinking.

**CO2: Explain** the fundamentals of Design Thinking and innovation.

**CO3: Apply** the design thinking techniques for solving problems in various sectors.

**CO4: Analyse** to work in a multidisciplinary environment.

**CO5: Evaluate** the value of creativity.

**UNIT – I**

**INTRODUCTION TO DESIGN THINKING:** Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

**UNIT - II**

**DESIGN THINKING PROCESS:** Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

**Activity:** Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

**UNIT - III**

**INNOVATION:** Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

**UNIT - IV**

**PRODUCT DESIGN:** Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

**Activity:** Importance of modeling, how to set specifications, Explaining their own product design.

**UNIT – V**

**DESIGN THINKING IN BUSINESS PROCESSES:** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

**Activity:** How to market our own product, about maintenance, Reliability and plan for startup.

**TEXTBOOKS:**

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

**REFERENCE BOOKS:**

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

**ONLINE LEARNING RESOURCES:**

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- [https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)
- [https://onlinecourses.nptel.ac.in/noc22\\_de16/preview](https://onlinecourses.nptel.ac.in/noc22_de16/preview)