# ACADEMIC REGULATIONS
# &
# CURRICULUM

**Applicable to the students admitted from the Academic Year 2026-27 Onwards**

## CHEMICAL ENGINEERING
**B. Tech. Program**


**MAHARAJ VIJAYARAM GAJAPATHI RAJ COLLEGE OF ENGINEERING**
**(Autonomous)**
(Approved by AICTE, New Delhi, and permanently affiliated to JNTUGV, Vizianagaram,
Listed u/s 2(f) & 12(B) of UGC Act 1956)
Vijayaram Nagar Campus, Chintalavalasa, Vizianagaram-535005, Andhra Pradesh.

The visionaries

**Late Dr. P V G Raju**
Raja Saheb of Vizianagaram
Founder Chairman-MANSAS
Ex-Minister for Education and Health, Govt. of AP
Ex Member of Parliament

**Late Dr. P. Anand Gajapathi Raju**
**Ex-Chairman-MANSAS**
Ex-Minister for Education and Health

Govt. of AP.
Ex-Member of Parliament.

**P. Ashok Gajapathi Raju**
**Chairman-MANSAS**
Governor of GOA State,
Ex-Union Minister for Civil Aviation,
Govt. of India.
Ex-Minister for Finance,
Govt. of AP

**Academic Regulations (R26M) for B. Tech (Regular-Full time)**
(Effective for the students admitted into I year from the Academic Year **2026-27** onwards)

## 1. Award of the Degree

Award of the B.Tech. Degree if he/she fulfils the following:

(i) 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).

(ii) Registers for **160** credits and secures all **160** credits.

## 2. Award of B.Tech. degree with Honors

1. A student will be declared eligible for the award of the B.Tech degree with Honors if he/she fulfills the following:
   (i) Student secures additional **18** credits fulfilling all the requisites of B.Tech program i.e., **178** credits.
   (ii) Registering for Honors is optional.
   (iii) Honors is to be completed simultaneously with B.Tech. program.

2. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, 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 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 clock hour of teaching (Lecture/Tutorial) or two clock 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 break term is for Six /eight weeks during which a student has the opportunity to pursue Internship/ apprenticeship/work-based vocational education and training. This is intended to meet the mandatory requirement of a student to carry out 2-credit Community Project and Mini Project modules. This is especially helpful for students who wish to exit after two semesters or four semesters of study.

## 6. Structure of the Undergraduate Program:

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 |
|---|---|---|---|
| 1. | Professional Core | 83 | 51.875 |
| 2. | Extended Open Elective Cluster (EOEC) | 22 | 13.75 |
| 3. | Generic Engineering Stream | 23 | 14.375 |
| 4. | Ability Enhancement Courses (AEC) | 8 | 5.0 |
| 5. | Value Added Courses (VAC) | 4 | 2.5 |
| 6. | Skill Enhancement Courses (SEC) | 10 | 6.25 |
| 7. | Projects | 10 | 6.25 |
| | **Total** | **160** | **100** |

## 7. Course Classification:

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

| Course Category | Course Modules | Total Credits |
|---|---|---|
| **Professional Core** | • **16 Professional Core Theory Mandatory of 3 credits each 16 * 3 = 48 credits**<br>• **5 Professional Core Elective Theory of 3 credits each 5 * 3 = 15 credits**<br>• **7 Professional Core Lab of 2 credits each 7 * 2 = 14 credits**<br>• **Projects (Mini & Major) (2 + 8) = 10 credits**<br>• **2 Department specific module (SEC) of 2 credits each = 2*2 = 4 credits** | **91** |
| **Basic Sciences** | • **M-I and M-II 2 * 3 credits = 6 credits**<br>• **Physics + Lab (3 + 1) credits = 4 credits**<br>• **Chemistry + Lab (3 + 1)credits = 4 credits**<br>• **Department Specific Math oriented courses 2 * 3 credits = 6 credits** | **20** |
| **Humanities & Management sciences** | • **AEC (Verbal communication = 2 credits;**<br>• **Written communication = 2 credits,**<br>• **Env. Studies = 2 credits; Community Project = 2 credits**<br>• **VAC (E & HV = 2 credits; Constitutional values/ Rights = 2 credits;)**<br>• **SEC (Quantitative Problem Solving = 2 credits)**<br>• **MEFA = 3 credits** | **17** |
| **Engineering Sciences/Professional Sciences** | **Open Elective Cluster**<br>• **5 Theory Mandatory modules. 5 * 3 credits = 15 credits**<br>• **1 Theory Elective module. 1 * 3 credits = 3 credits**<br>• **2 Lab/practice modules. 2 * 2 credits = 4 credits, which is an elective cluster where students can choose from multiple clusters which they can opt for as secondary skill with total of 22 credits.**<br>• **Procedural Programming + Lab (3 +1) credits = 4 credits**<br>• **Computer Aided Engineering Drawing = 2 credits**<br>• **Engineering Workshop = 2 credits** | **32** |

| | | |
|---|---|---|
| | • **Office tools & Social Media Etiquette = 2 credits** | |
| | | **160** |
| **Honors** | **Optional For Honors (In Professional Core Area as a deep dive into Professional Elective Cluster)** | **18** |
| | **4 Year Honors Degree** | **178** |

**Programme Pattern**

i. Total duration of the B. Tech (Regular) Program is four academic years of 8 semesters.
ii. A semester comprises 90 working days and an academic year is divided into two semesters.
iii. There will be an Induction Program before the commencement of the First Semester for the newly admitted students in order to provide orientation and acclimatization to the college campus and professional learning environment. Several activities such as physical activity, creative arts, universal human values, literary, proficiency modules, lectures by eminent people, visits to local areas, familiarization to the departments, innovation activities etc., form part of the Induction Program.
v. Value Added Courses (VAC) like Constitutional Rights/Values and Ethics and Human Values are mandatory credit courses for all the undergraduate students.
vi. Ability Enhancement Courses (AEC) like Verbal Communication skills, Written Communication skills, Environmental Studies and Community Project are mandatory credit courses for all the undergraduate students.
vii. Skill Enhancement Courses (SEC) like Office Tools & Social Media Etiquette, Engineering Workshop, Quantitative Problem Solving Techniques and Two Departmental Specific Modules are mandatory credit courses for all the undergraduate students.
viii. Undergraduate degree with Honors is offered as an option for the students having good academic record.
xvi. College shall 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.

## 8. Evaluation Process

- The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for 3 credit theory subjects, 50 Marks for 2 credit theory courses and 100 marks for practical subjects. Community Project and Mini Project shall be evaluated for 50 marks while Main Project work shall be evaluated for 200 marks.
- A student has to secure not less than 35% of marks in the semester end examination and a minimum of 40% of marks in the sum total of the Continuous Assessment (CA) and Summative Assessment (SA)

marks taken together for the theory, practical, design, drawing subject or project etc.

**THEORY COUSES**

| Assessment Method | Marks |
|---|---|
| Continuous Assessment (CA) | 40 |
| Summative Assessment (SA) | 60 |
| **Total** | **100** |

i. For theory subject, the distribution shall be 40 marks for Continuous Assessment and 60 marks for the Summative Assessment.

ii. For practical subject, the distribution shall be 40 marks for Continuous Assessment and 60 marks for the Summative Assessment.

**a) Continuous Assessment (5- unit/3 Credit courses)**

i. Continuous Assessment, which is evaluated for 40 Marks is divided into 2 parts: Periodic Assessment (PA) examinations for 25 Marks and Teacher Assessment (TA) for 15 Marks. There shall be two Periodic Assessment (PA) examinations each of 25 marks during a semester. The weighted average in 80/20 ratio will be taken for 25 marks. The duration of exam is 90 minutes. The PA question paper contains 3 long answer questions with internal choice. Each Long answer question carries 7 marks. (3 * 7M = 21 marks). This will be scaled up to 25 marks)

ii. The first PA examination shall be conducted on Units I & II with either/or type question from each unit and the second PA examination shall be conducted on Units III, IV and V with either/or type question from each unit.

iii. The Teacher Assessment (TA) for 15 marks shall be based on assignments/projects/presentations /surprise tests/quizzes which the concerned course owner/subject teacher shall design.

The weighted average in 80/20 ratio is calculated in the following manner. For example:

Marks obtained in first PA exam : 25
Marks obtained in second PA exam : 20
Final PA Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one PA examination, the final PA 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 PA: Absent
Marks obtained in second PA: 25
Final PA Marks: (25x0.8) + (0x0.2) =20

Final Continuous Assessment marks shall be evaluated as follows:

CA = Final PA + TA

**b) Summative Assessment - Evaluation Pattern for 5-Unit/3-Credit courses**

Summative Assessment examination of 3-credit theory subjects shall have the following pattern:

- The SA will be conducted for 60 Marks (**180 minutes**)
- Question Paper contains two parts: Part – A is for 50 Marks and Part – B is for 10 Marks.
- **In Part – A**, there shall be one question from each of the 5 units (with either/or choice) which will be evaluated for 10 marks each
- **In Part – B**, there will be 1 question of 10 marks (with either/or choice) that may be a case study or comprehensive examination treating the course as one complete whole.

**c) Continuous Assessment (5-unit/2 Credit courses)**

For a 2-credit theory course, Continuous Assessment is evaluated for 20 Marks and shall only include the Periodic Assessment (PA) examination. There will be no Teacher Assessment component for these courses. There shall be two PA examinations each of 20 marks. The weighted average in 80/20 ratio will be taken for 20 marks. The duration of exam is **90 minutes**. The PA question paper contains 3 long answer questions with internal choice. Each Long answer question carries 6 marks. (3 * 6M = 18 marks. This will be scaled up to 20 marks)

**d) Summative Assessment – Evaluation Pattern for 5-Unit/2-Credit courses**

Summative Assessment examination of 2-credit theory courses shall have the following pattern:

- The Examination will be conducted for 30 Marks (5 * 6 Marks).
- Question Paper contains 5 questions (with either/or choice), one from each unit.
- The duration of exam is for **120 minutes**.

**PRACTICAL COURSES**

| Assessment Method | Marks |
|---|---|
| Continuous Assessment (CA) | 40 |
| Summative Assessment (SA) | 60 |
| **Total** | **100** |

a) For practical subjects, there shall be a Continuous Assessment during the semester for 40 marks and Summative Assessment for 60 marks.

b) The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work in the laboratory shall be evaluated by the concerned laboratory teacher based on the regularity/record/viva and the Pre-Summative Assessment Examination shall be conducted before the end of the semester.

c) The SA shall be evaluated for 60 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same domain.

d) The Summative Assessment laboratory examination shall be conducted for **120 minutes** and assessment includes:

- Knowledge on Principles/concepts/Procedure: 20 Marks
- Experimental design /work, Results-Interpretation and analysis: 30 marks
- Viva voce: 10 marks.

**e) Computer Aided Engineering Drawing – Evaluation Pattern**

| Assessment Method | Marks |
|---|---|
| Continuous Assessment (CA) | 40 |
| Summative Assessment (SA) | 60 |
| **Total** | **100** |

a) The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. The Pre-Summative Assessment examination pattern shall consist of 3 questions (either/or type) of 5 marks each.

b) The Summative Assessment examination shall be evaluated for 60 marks, conducted by the concerned teacher and a senior expert in the subject from the same domain.

c) The question paper shall contain 3 questions (with either/or choice). Each question will be of 20 marks (5 marks for free hand drawing and list of commands and 15 marks for final drawing prepared in AutoCAD). A student shall answer all questions.

**f) Computer Aided Geometric Design and Assembly Lab – Evaluation Pattern**

| Assessment Method | Marks |
|---|---|
| Continuous Assessment (CA) | 40 |
| Summative Assessment (SA) | 60 |
| **Total** | **100** |

1. The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work shall be evaluated by the concerned subject teacher based on class reports and submissions. The pre-summative examination question paper consists of two questions: one on modeling & drafting and one on assembly & drafting. Each question carries 5 marks. Student must answer both questions. And the remaining 5 marks are allocated for viva-voce.

2. The SA examination shall be evaluated for 60 marks, conducted by the concerned teacher and a senior expert in the subject from the same or related department.

3. The SA examination question paper consists of two questions: one on modeling & drafting and one on assembly & drafting. Each question carries 25 marks (divided into 5 marks for free hand drawing & procedure and 20 marks for final drawings (modeling/ assembly/ drafting). Student must answer both questions and the remaining 10 marks are allocated for viva-voce.

**10. Community Project:** There will be a summer break of 4 to 6 weeks at the end of each academic year to provide opportunity to students to engage in internships with industry/government agencies/NGO etc. These internships are intended to give exposure to the students through Community Projects and Mini Projects.

- A student shall identify and provide a solution to the problem relevant to society.

- A student shall engage at least 30 hours on community project. Community project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC comprising of HoD, Two senior faculty and guide shall review the progress.

**11. Mini Project:**

- A student shall undergo internship (Physical/Virtual) for a period of 4 weeks and provide solution to the problem relevant to Industry/ Modern tool during the vacation after VI semester and submit comprehensive report/certificate (For virtual internship) issued by external agencies.

- The recommended Virtual Internships offered by external agencies/regulating bodies like AICTE/APSCHE etc, conversions and appropriate grades/marks are to be approved by the BoS at the beginning of the semester.

- Mini project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC shall prepare rubrics for assessment.

## 12. Skill Enhancement Course:

Skill Enhancement Course is assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end examination.

| Assessment Method | Marks |
|---|---|
| Continuous Internal | 40 |
| Semester End Examination | 60 |
| Total | 100 |

**Continuous Internal Assessment : (40 Marks)**

Continuous assessment : 20 Marks
Internal test : 20 Marks

The end examination shall be evaluated for 60 marks, conducted by the concerned course teacher and a senior expert in the subject from the same department.

Procedure : 20 Marks
Experimental work & Results : 30 marks
Viva voce : 10 marks.

The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course (Minimum 30 hours) 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.

The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the BoS at the beginning of the semester.

If a student prefers to take a certificate course offered by external agency and approved by BoS, 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 BoS.

**Evaluation pattern for Quantitative Problem Solving Techniques :**

The Course is assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end examination.

| Assessment Method | Marks |
|---|---|
| Continuous Internal | 40 |
| Semester End Examination | 60 |
| Total | 100 |

**Continuous Internal Assessment : (40 Marks)**

| | |
|---|---|
| Continuous assessment | : 20 Marks |
| Internal test | : 20 Marks |

The end examination shall be evaluated for 60 marks, conducted by the concerned course teacher and a senior expert in the subject from the same department.

| | |
|---|---|
| Objective Test<br>(MCQs, 50 Questions, each one mark) | : 50 Marks |
| Viva voce | : 10 marks. |

## 13. Main Project Work:

The 4th Year of study comprises only self-study courses giving opportunity to students to spend one full year as an intern at various organizations (government/private) in pursuance of his/her career aspiration. The student is also expected to complete the Main Project during this period. At the end of the year, the candidate shall submit the main project report.

The project report shall be evaluated with an external examiner. The total marks for project work is **200 marks** and the distribution shall be **80 marks** for continuous assessment and **120 marks** for summative assessment. The supervisor assesses the student for 40 marks (Report: 20 marks, Seminar: 20 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 40 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 120 marks.

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

## 14. Massive Open Online Courses (MOOCs):

- It is recommended to register and complete minimum two courses through MOOCs approved by the BoS. A student can pursue courses other than core through MOOCs. A student is not permitted to register and pursue core courses through MOOCs.

- The student shall register for the (Minimum of 12 weeks) courses offered by SWAYAM/NPTEL as Program elective/Open elective with the approval of the BoS. The Head of the Department shall appoint one mentor for each MOOC. The student has to submit the pass certificate issued by SWAYAM/NPTEL after completion of the course.

- 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 Institution.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

## 15. Academic Bank of Credits (ABC)

The Institution is part of the Academic Bank of Credits (ABC) initiative to promote increased opportunity of mobility for a student (as per NEP 2020). As such,

i. A student, upon joining the institution, will become part of the ABC.

ii. All credits earned by the students in the institution as well as through MOOCs will be reflected in his/her account in the ABC

iii. The student will be able to avail transfer of credits earned from other institutions to his account as per the regulations of UGC/AICTE/JNTUGV declared from time to time.

## 16. Guidelines for offering Honors

The objective of introducing B.Tech.(Honors) 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 program 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 18 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.

iii. A student is permitted to register for Honors and is allowed to take maximum of two subjects per semester pertaining to the Honors.

iv. Separate class work and timetable of the courses offered under Honors program shall be arranged.

v. Courses that are used to fulfill 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 courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course satisfying the criteria for credit mobility.

If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

vii. 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 program.

viii. 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.

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

**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 CGPA obtained in the major degree program. CGPA shall be taken up to IV semester in case of regular and Lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

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

iv. An honor 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. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

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 at the respective institutions.

**17. Attendance Requirements:**

i. A student shall be eligible to appear for the external examinations if he/she acquires a minimum 75% of attendance in aggregate of all the subjects.

ii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted.

iii. 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.

iv. 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.

v. 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.

vi. Given the extensive scope for learning in blended mode, a student can seek consideration of time spent online or on course projects in lieu of attendance. The college academic committees will arbiter engagement of students on a case-to-case basis where a student falls short of the requisite attendance.

vii. For induction program attendance shall be maintained as per AICTE norms.

**18. Promotion Rules:**

A student shall be promoted from IV semester to V semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either III semester or IV semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Two regular and Two supplementary examinations of I semester
- Two regular and One supplementary examinations of II semester
- One regular examination and One supplementary examination of III semester

- One regular examination of IV semester.

A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either V Semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Three regular and Three supplementary examinations of I semester
- Three regular and Two supplementary examinations of II semester
- Two regular and Two supplementary examinations of III semester
- Two regular and One supplementary examinations of IV semester
- One regular and One supplementary examination of V semester
- One regular examination of VI semester.

**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 letter | Grade points |
|---|---|---|
| ≥ 90 | A+ (Outstanding) | 10 |
| ≥ 80 and < 90 | A (Excellent) | 9 |
| ≥ 70 and < 80 | B (Very Good) | 8 |
| ≥ 60 and < 70 | C (Good) | 7 |
| ≥ 50 and < 60 | D (Average) | 6 |
| ≥ 40 and < 50 | E (Pass) | 5 |
| < 40 | F (Fail) | 0 |
| Absent | Ab (Absent) | 0 |

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

**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.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

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.,

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

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

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

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

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

**Letter Grade**: It is an index of the performance of students in a said course. Grades are denoted by the letters $A^+$, A, B, C, D 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:

| Class Awarded | CGPA Secured |
|---|---|
| First Class with Distinction | ≥ 7.0 |
| First Class | ≥ 6.0 and < 7.0 |
| Second Class | ≥ 5.0 and < 6.0 |
| Pass Class | ≥ 4.0 and < 5.0 |

**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 = CGPA x 10**

## 20. With–holding of Results

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

## 21. Multiple Entry / Exit Option

With NEP setting in, the theme is we will need to give different entry-exit options for students and a possibility to tailor a 4-year course or even a 3-year exit degree to suit their interests and requirements.

- Exit-Entry at each year of study through the entire 4-year duration.
- Possible multiple Degree Options with different Credit requirements that provide an option to a student to pick an option that best suits his/her interests and requirements.

**Note**: Four Year undergraduate program (FYUP) with or without Honors is the most recommended exit. But if for some unavoidable reasons, a student needs to exit at the end of Year I, Year II, Year III, the following would be the respective exit requirements with a tentative certificate/ diploma/ degree defined.

| Year of Exit | Degree | Credits Required to be Earned During Course Work | Exit Extra Credits (Crash Course & Exam) | Total Credits |
|---|---|---|---|---|
| End of Year I | Office Tools Certificate (Or something equivalent as determined by Affiliating University) | 40 | 6 | 46 |
| End of Year II | Diploma in Discipline 1 (Or something equivalent as determined by Affiliating University) | 88 | 8 | 96 |
| End of Year III | Bachelor in Vocational Sciences in **Discipline1** (Or something equivalent as determined by Affiliating University) | 136 | 0 | 136 |
| End of Year IV (Without Honors) | Bachelor of Technology in **Discipline 1**) (Or something equivalent as determined by Affiliating University) | 160 | 0 | 160 |

| Year of Exit | Degree | Credits Required to be Earned During Course Work | Exit Extra Credits (Crash Course & Exam) | Total Credits |
|---|---|---|---|---|
| End of Year IV (With Honors) | Bachelor of Technology with Honors in **Discipline 1**) (Or something equivalent as determined by Affiliating University) | 176 | 0 | 176 |

**Note:** The exit extra credits at Year II and Year III would essentially come from critical courses as determined by BoS from the following semester.

**(a) Exit Policy:**

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

i) **UG Certificate in (Field of study/discipline)** - Program duration:
First Year (first two semesters) of the undergraduate program, 40 credits followed by an additional exit 6 credit bridge course. The 6 extra credits would be to make the certificate self-sufficient, with one 3-Credit Course on Taxation and one 3-Credit Course on Accounting that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Program duration:
First two years (first four semesters) of the undergraduate program, 88 credits followed by an additional exit of 8-credit bridge course with 2 Integrated 4 Credit courses in Major with 3+1 Theory and Lab distribution administrated as a Crash course in 1 month which would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)-** Program duration:
First three years (first six semesters) of the undergraduate program, 120 credits.

**(b) Entry Policy:**

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

**Note:** The institution 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, State government and the affiliating univeristy.

## 22. Transitory Regulations

Discontinued, detained or failed candidates are eligible for readmission as and when the semester is offered after fulfillment 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.

## 23. Medium of Instruction:

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

## 24. Student Transfers:

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

## 25. 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 institution is final.
e. The institution 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 institution.
f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

* * *

## Regulations for MALPRACTICES during the conduct of examinations

| | Nature of Malpractices/Improper conduct | Punishment |
|---|---|---|
| 1.a | If the candidate 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) - **FIRST TIME** (whether copied or not) | Expulsion from the examination hall and cancellation of the performance in that subject only.<br>• To keep the CC footage of the act as an evidence.<br>• To obtain a statement from student and get it authorized by observer and Chief superintendent. |
| 1.b | If the candidate 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) - **SECOND TIME**(whether copied or not) | 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, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.<br>• To keep the CC footage of the act as an evidence.<br>• To obtain a statement from student and get it authorized by observer and Chief superintendent. |
| 1.c | If the candidate 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) - **REPITITION OF THE ABOVE ACT** (After second time and whether copied or not) | Nature of punishment to be given for the improper conduct shall be as per the recommendations of the committee.<br>• The committee comprising of Principal, Vice principal, Chief superintendent, Controller of Examinations and HoD to discuss and initiate the action to be taken and recommend.<br>• To keep the CC footage of the act as evidence.<br>• To obtain a statement from student and invigilator and authorized by Chief superintendent. |
| 2.a. | If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved.<br>• To keep the CC footage of the act as an evidence. |

| | | |
|---|---|---|
| 2.b | If the candidate communicates through cell phones / through any other means with any candidate or persons in or outside the exam hall in respect of any matter.<br>(i) If the communication is with the person(s) who belongs to our college. | Confiscation of the mobile or electronic gadgets involved and 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, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.<br>• To obtain all relevant proofs of evidence from the Mobile/ gadgets and handing over of the same to the candidate.<br>• To keep the CC footage of the act as evidence.<br>• To obtain a statement from student and invigilator and authorized by observer and Chief superintendent. |
| | (ii) If the communication is with the person(s) outside the campus or people who are not related to our college. | Confiscation of the mobile or electronic gadgets involved and 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, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.<br>• To obtain all relevant proofs of evidence from the Mobile/ gadgets and handing over of the same to the candidate.<br>• To keep the CC footage of the act as evidence.<br>• To obtain a statement from student and invigilator and authorized by observer and Chief superintendent.<br>• The person(s) involved should be handed over to the police and a case is registered against him. |
| 3. | If the candidate 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 practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider/candidate not on rolls, he will be handed over to the police and a case is registered against him. |

| | | |
|---|---|---|
| | | • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs.<br>• To keep the CC footage of the act as an evidence.<br>• To obtain a statement from student, invigilator, subject expert and authorized by observer and Chief Superintendent. |
| 4 | If the candidate mishandles 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.<br>Also, if the answer script is mutilated / damaged disturbing the shape, of the script, answers, the bar code intentionally. | 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.<br><br>In addition to the above punishment, a committee shall be constituted and recommends appropriate punishment for the improper conduct.<br>• To keep the CC footage of the act as an evidence.<br>• To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent. |
| 5. | Uses objectionable, abusive or offensive language in the Examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject only.<br>• To Obtain a statement from student and invigilator and get it authorized by Observer and Chief superintendent. |
| 6. | Refuses to obey the orders of the Chief Superintendent/ACE/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. 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.<br>• To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs<br>• To keep the CC footage of the act as an evidence.<br>• To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent. |

| | | |
|---|---|---|
| 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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.<br><br>• To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action.<br>• To keep the CC footage of the act as an evidence.<br>• To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent. |
| 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.<br><br>• To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs<br>• To keep the CC footage of the act as an evidence.<br>• To obtain a statement from student and invigilator and authorized by observer and Chief superintendent.<br>• The candidate shall be handed over to Police and register a case. |
| 9. | If a 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. | If the student belongs to our 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. 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.<br>• To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action.<br>• To keep the CC footage of the act as an evidence.<br>• To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent. |
| 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.<br>• To keep the CC footage of the act as an evidence(If any).<br>• To obtain a statement from invigilator and any others as witness authorized by observer and Chief superintendent. |
| 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.<br>• To Obtain a statement from Valuer / Chief Valuer authorized by Spot Coordinator and Controller of Examinations. |

* * *

# Ragging

## 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, Embarrassing and Humiliation | 6 Months | + | Rs. 1,000/- |
| Assaulting or Using Criminal force or Criminalintimidation | 1 Year | + | Rs. 2,000/- |
| Wrongfully restraining or confining or causing hurt | 2 Years | + | Rs. 5,000/- |
| Causing grievous hurt, kidnapping or Abducts or rape or committing unnaturaloffence | 5 Years | + | Rs. 10,000/- |
| Causing death or abetting suicide | 10 Months | + | Rs. 50,000/- |

**In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 – 1288**

**LET US MAKE MVGR A RAGGING FREE CAMPUS**

ABSOLUTELY SAY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

**ACADEMIC REGULATIONS (R26) FOR B.TECH. (LATERAL ENTRY SCHEME)**

(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year **2026-2027** onwards)

**1. Award of the Degree**

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils th 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 18 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 <u>six</u> 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 VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either V Semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Three regular and Three supplementary examinations of I semester
- Three regular and Two supplementary examinations of II semester
- Two regular and Two supplementary examinations of III semester
- Two regular and One supplementary examinations of IV semester
- One regular and One supplementary examination of V semester
- One regular examination of VI semester.

iii. 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).

* * *

**R26-MVGR**

**COURSE STRUCTURE AND CURRICULUM**

**B.TECH (Regular/Honors)-CHEMICAL ENGINEERING**

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

## I Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MMATT001 | Linear Algebra and Differential Equations | 3 | 1 | 0 | 3 |
| 2 | R26MMATT002 | Multi Variables and Vector Calculus | 3 | 1 | 0 | 3 |
| 3 | R26MCHYT001 | Chemistry | 3 | 0 | 0 | 3 |
| 4 | R26MCIVT001 | Environmental Studies | 2 | 0 | 0 | 2 |
| 5 | R26MENGT001 | Verbal Communication Skills | 2 | 0 | 0 | 2 |
| 6 | R26MENGT004 | Ethics and Human Values-I | 2 | 0 | 0 | 2 |
| 7 | R26MCHYL001 | Chemistry Lab | 0 | 0 | 2 | 1 |
| 8 | R26MSCSL001 | Office Tools and Social Media Etiquette | 0 | 0 | 3 | 2 |
| 9 | R26MMECW001 | Engineering Workshop | 1 | 0 | 2 | 2 |
| | **Total Credits** | | | | | **20** |

## II Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MMATT003 | Probability and Statistics and Numerical Methods | 3 | 0 | 0 | 3 |
| 2 | R26MPHYT001 | Physics | 3 | 0 | 0 | 3 |
| 3 | R26MCHET001 | Introduction to Chemical Engineering | 3 | 0 | 0 | 3 |
| 4 | R26MSCST001 | Procedural Programming | 3 | 0 | 0 | 3 |
| 5 | R26MENGT002 | Written Communication Skills | 2 | 0 | 0 | 2 |
| 6 | R26MENGT003 | Constitutional Values | 2 | 0 | 0 | 2 |
| 7 | R26MPHYL001 | Physics Lab | 0 | 0 | 2 | 1 |
| 8 | R26MSCSL001 | Procedural Programming Lab | 0 | 0 | 2 | 1 |
| 9 | R26MMECD001 | Computer Aided Engineering Drawing | 1 | 0 | 2 | 2 |
| | **Total Credits** | | | | | **20** |

## III Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MCHET002 | Fluid Mechanics for Chemical Engineers | 3 | 0 | 0 | 3 |
| 2 | R26MCHET003 | Chemical Process Calculations | 3 | 0 | 0 | 3 |
| 3 | R26MCHET004 | Mechanical Unit Operations | 3 | 0 | 0 | 3 |
| 4 | R26MCHET005 | Chemical Engineering Thermodynamics | 3 | 0 | 0 | 3 |
| 5 | R26MCSCT001 | Data Structures | 3 | 0 | 0 | 3 |
| 6 | R26MCSCT002 | Python Programming | 3 | 0 | 0 | 3 |
| 7 | R26MCHEL001 | Fluid Mechanics for Chemical Engineers Lab | 0 | 0 | 2 | 2 |
| 8 | R26MCHEL002 | Mechanical Unit Operations Lab | 0 | 0 | 2 | 2 |
| 9 | R26MCSCL001 | Data Structures Lab using Python | 0 | 0 | 2 | 2 |
| | **Total Credits** | | | | | **24** |

## IV Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MCHET006 | Process Heat Transfer | 3 | 0 | 0 | 3 |
| 2 | R26MCHET007 | Chemical Technology | 3 | 0 | 0 | 3 |
| 3 | R26MCHET008 | Chemical Reaction Engineering-I | 3 | 0 | 0 | 3 |
| 4 | R26MCHET009 | Mass Transfer-I | 3 | 0 | 0 | 3 |
| 5 | R26MAICT001 | Fundamentals of AI | 3 | 0 | 0 | 3 |
| 6 | R26MCSCT005 | Software Engineering and Testing | 3 | 0 | 0 | 3 |
| 7 | R26MCHEL003 | Process Heat Transfer Lab | 0 | 0 | 2 | 2 |
| 8 | R26MCHEL004 | Chemical Reaction Engineering Lab | 0 | 0 | 2 | 2 |
| 9 | R26MAICL001 | AI Applications Lab | 0 | 0 | 2 | 2 |
| **Total Credits** | | | | | | **24** |

## V Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MCHET010 | Transport Phenomena | 3 | 0 | 0 | 3 |
| 2 | R26MCHET011 | Chemical Reaction Engineering-II | 3 | 0 | 0 | 3 |
| 3 | R26MCHET012 | Mass Transfer-II | 3 | 0 | 0 | 3 |
| 4 | R26MCHET013 | Process Instrumentation | 3 | 0 | 0 | 3 |
| 5 | R26MCHETXXX | DSC-E1 | 3 | 0 | 0 | 3 |
| 6 | R26MAICT002 | Generative and Agentic AI | 3 | 0 | 0 | 3 |
| 7 | R26MCHEL005 | Mass Transfer Lab | 0 | 0 | 2 | 2 |
| 8 | R26MCHEL006 | Computational lab for Chemical Engineers | 0 | 0 | 2 | 2 |
| 9 | R26MCHEP001 | Community Project | 0 | 0 | 2 | 2 |
| **Total Credits** | | | | | | **24** |

## VI Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MCHET014 | Process Modelling and Simulation | 3 | 0 | 0 | 3 |
| 2 | R26MCHET015 | Process Dynamics and Control | 3 | 0 | 0 | 3 |
| 3 | R26MCHET016 | Plant Design and Economics for Chemical Engineers | 3 | 0 | 0 | 3 |
| 4 | R26MMBAT001 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 5 | R26MCHETXXX | DSC E2 | 3 | 0 | 0 | 3 |
| 6 | R26MCHETXXX | DSC E3 | 3 | 0 | 0 | 3 |
| 7 | R26MCHEL007 | Process Control and Simulation Lab | 0 | 0 | 3 | 2 |
| 8 | R26MCHEL008 | MATLAB based Programming lab / Computational Fluid Dynamics lab (SEC) | 0 | 0 | 3 | 2 |
| 9 | R26MMATT007 | Quantitative Problem Solving Techniques | 2 | 0 | 0 | 2 |
| **Total Credits** | | | | | | **24** |

## VII Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MCHET017 | Material Science and Engineering (Self-Study) | 3 | 0 | 0 | 3 |
| 2 | R26MCHETXXX | DSC E4 (Self-Study/MOOCS) | 3 | 0 | 0 | 3 |
| 3 | R26MCHETXXX | DSC E5 (Self-Study/MOOCS) | 3 | 0 | 0 | 3 |
| 4 | R26MCHEP002 | Mini Project | 0 | 0 | 2 | 2 |
| 5 | R26MCHEL009 | Industrial Safety Training/ Training in Pharmaceutical industries/ ASPEN PLUS (SEC) | 0 | 0 | 3 | 2 |
| **Total** | | | | | | **13** |

## VIII Semester

| S. No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | R26MAICT003 | AI Powered Web Design (Self Study / MOOCs) | 3 | 0 | 0 | 3 |
| | R26MAICT004 | Robotic Process Automation (Self Study / MOOCs) | 3 | 0 | 0 | 3 |
| | R26MAICT005 | Ethical Considerations in AI (Self Study / MOOCs) | 3 | 0 | 0 | 3 |
| 2 | R26MCHEP003 | Major-Dissertation/Academic Project-Major | 0 | 0 | 5 | 8 |
| **Total Credits** | | | | | | **11** |

## DEPARTMENT ELECTIVE COURSES

### Specialization-1: Advanced Chemical Engineering

| Type of Course | Course Code | Course Title | Semester |
|---|---|---|---|
| DSC-E1 | R26MCHET018 | Petroleum Refining | V |
| DSC-E2 | R26MCHET019 | Biochemical Engineering | VI |
| DSC-E3 | R26MCHET020 | Industrial Safety and Hazards Management | VI |
| DSC-E4 | R26MCHET021 | Basic Environmental Engineering and Pollution Abatement | VII |
| DSC-E5 | R26MCHET022 | Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems | VII |

### Specialization-2: Bioprocess Technologies

| Course Code | Type of Course | Course Code | Semester |
|---|---|---|---|
| DSC-E1 | R26MCHET023 | Fluidization Engineering | V |
| DSC-E2 | R26MCHET024 | Biochemical Engineering | VI |
| DSC-E3 | R26MCHET025 | Chemical Process Utilities | VI |
| DSC-E4 | R26MCHET026 | Advanced Reaction Engineering | VII |
| DSC-E5 | R26MCHET027 | Chemical Process Intensification | VII |

**R26-MVGR**
**COURSE STRUCTURE**

**B. Tech. (Honors) - Chemical Engineering**
(Applicable from the Academic Year 2026-27 Onwards)

**Specialization-1: Advanced Chemical Engineering**

| S. No | Course Code | Course Title | L | T | P | Credits | Sem |
|---|---|---|---|---|---|---|---|
| 1 | R26MCHEHT01 | Process Equipment Design | 3 | 0 | 0 | 4 | VI |
| 2 | R26MCHEHT02 | Advanced Reaction Engineering | 3 | 0 | 0 | 4 | VII |
| 3 | R26MCHEHT03 | Process Integration | 3 | 0 | 0 | 3 | VII |
| 4 | R26MCHEHT04 | Membrane Technology | 3 | 0 | 0 | 4 | VIII |
| 5 | R26MCHEHT05 | Hydrogen Energy: Production, Storage, Transportation And Safety | 3 | 0 | 0 | 3 | VIII |
| **Total Credits** | | | | | | **18** | |

**Specialization-2: Bioprocess Technologies**

| S. No | Course Code | Course Title | L | T | P | Credits | Sem |
|---|---|---|---|---|---|---|---|
| 1 | R26MCHEHT06 | Industrial Biotechnology | 3 | 0 | 0 | 4 | VI |
| 2 | R26MCHEHT07 | Biomass Conversion And Biorefinery | 3 | 0 | 0 | 4 | VI |
| 3 | R26MCHEHT08 | Biological process design for wastewater treatment | 3 | 0 | 0 | 3 | VII |
| 4 | R26MCHEHT09 | Thermal Processing of Foods | 3 | 0 | 0 | 4 | VIII |
| 5 | R26MCHEHT10 | Polymer Reaction Engineering | 3 | 0 | 0 | 3 | VIII |
| **Total Credits** | | | | | | **18** | |

**B.Tech. (Honors) Total Credits: 178**

## EXTENDED OPEN ELECTIVE CLUSTERS

| Artificial Intelligence Cluster(AIC)<br>(for MEC, ECE, EEE, CIV and CHE)<br>(Not for CSE/CSIT/AIML/DS/CIC) | | | |
|---|---|---|---|
| **Type of Course** | **Course code** | **Course Title** | **Sem** |
| EOEC-T1 | R26MCSCT001 | Data Structures | III |
| EOEC-T2 | R26MCSCT002 | Python Programming | III |
| EOEC-L1 | R26MCSCL001 | Data Structures Lab in Python | III |
| EOEC-T3 | R26MAICT001 | Fundamentals of AI | IV |
| EOEC-T4 | R26MCSCT005 | Software Engineering & Testing | IV |
| EOEC-L2 | R26MAICL001 | AI Applications Lab | IV |
| EOEC-T5 | R26MAICT002 | Generative and Agentic AI | VI |
| EOEC- E1 Self study / Moocs | R26MAICT003 | AI Powered Web Design (Self Study / MOOCs) | VIII |
| | R26MAICT004 | Robotic Process Automation (Self Study / MOOCs) | |
| | R26MAICT005 | Ethical Considerations in AI (Self Study / MOOCs) | |

| R26MMATT001 | LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS (Common to all branches) | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 40 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Basic Calculus and Matrices | **3** | **0** | **0** | **3** |

**Course Objective**

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Solve system of equations by Direct method. **(BL3)** |
| 2 | Make use of Linear Algebra techniques to find higher powers and inverse of Matrices and quadratic forms.**(BL3)** |
| 3 | Solve first order differential equations and make use of them to deal with real word problems. **(BL3)** |
| 4 | Solve the higher order differential equations to make use of them to deal with real word problems. **(BL3)** |
| 5 | Make use Laplace transforms to solve initial value problems. **(BL3)** |
| 6 | Formulate Mathematical models and estimate appropriate physical quantities. **(BL6)** |

**SYLLABUS**

| **Unit 1** | **LINEAR ALGEBRA-1** | **8 hr** |
|---|---|---|

Rank; Consistency criteria; non-homogeneous systems; Homogeneous systems; Characteristic equation; Eigenvalues; Eigenvectors; Properties.

| **Unit 2** | **LINEAR ALGEBRA-2** | **8 hr** |
|---|---|---|

Cayley-Hamilton Theorem; Higher powers; Matrix polynomials; Inverse of Matrix; Diagonalization; Quadratic forms (QF); Canonical forms (CF); Reduction of QF to CF.

| **Unit 3** | **FIRST ORDER DIFFERENTIAL EQUATIONS & APPLICATIONS** | **8 hr** |
|---|---|---|

Linear Differential Equations (DE); Solving Linear DE; Bernoulli's DE; Solving Bernoulli's DE; Exact DE; Non-exact DE; Newton's law of cooling; Laws of natural growth and decay.

| **Unit 4** | **HIGHER ORDER DIFFERENTIAL EQUATIONS** | **8 hr** |
|---|---|---|

Homogeneous linear differential equations (DE)-1; Homogeneous linear DE -2; Non-homogeneous linear DE $(e^{ax})$; Non-homogeneous linear DE $(sin\, ax\, /\, cos\, ax)$; Non homogeneous linear DE $(x^k)$; Non-homogeneous linear DE $\left(e^{ax}\, v(x)\right)$ ; Particular integrals; Method of variation of parameters.

| **Unit 5** | **LAPLACE TRANSFORMS** | **8 hr** |
|---|---|---|

Laplace transform (LT) of elementary functions-1; LT of elementary functions-2; LT using elementary properties-1; LT using elementary properties-2; Inverse LT (Partial Fractions); Convolution theorem; Initial value problems (IVP); Solving IVP.

LEARNING RESOURCES

**TEXTBOOKS:**


| | |
|---|---|
| 1 | B.S.Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, 2017. |
| 2 | T.K.V. Iyengar et al, *Engineering Mathematics*, S. Chand Publishers, Revised edition. |

| REFERENCE BOOKS: | |
|---|---|
| 1 | Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2011. |
| 2 | B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010. |
| 3 | T. Veerarajan, *Higher Engineering Mathematics*, Tata McGraw-Hill, 2008. |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL 3 | x | | | | |
| CO2 | BL 3 | | x | | | |
| CO3 | BL 3 | | | x | | |
| CO4 | BL 3 | | | | x | |
| CO5 | BL 3 | | | | | x |
| CO6 | BL 6 | x | x | x | x | x |

| R26MMATT002 | MULTI VARIABLES AND VECTOR CALCULUS (Common to all branches) | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 40 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Basic Calculus | **3** | **0** | **0** | **3** |

**Course Objective**

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Test and find for maxima and minima for functions of several variables. (**BL6**) |
| 2 | Evaluate double and triple integrals of functions of several variables. (**BL5**) |
| 3 | Apply the concepts of gradient, curl and divergence to compute and analyze scalar and vector fields. (**BL3**) |
| 4 | Estimate the work done against a field, circulation and flux using vector calculus. (**BL6**) |
| 5 | Solve the partial differential equations by various methods. (**BL3**) |
| 6 | Formulate Mathematical models and estimate appropriate physical quantities. (**BL6**) |

| **Unit 1** | **MULTIVARIABLE CALCULUS** | **8 hr** |
|---|---|---|

Partial derivative; Total derivative; Chain rule; Taylor's Series for functions of two variables; Maclaurin's series; Jacobian and its properties; Maxima and minima; Lagrange's method of undetermined multipliers.

| **Unit 2** | **MULTIPLE INTEGRALS** | **8 hr** |
|---|---|---|

Double integrals; Double integrals over a region; Double integrals in polar co-ordinates; Change of order; Change of variables in double integrals; Triple integrals; Change of variables; Applications of double and triple integrals.

| **Unit 3** | **VECTOR DIFFERENTIATION** | **8 hr** |
|---|---|---|

Gradient; Normal vector to the surface; Angle between surfaces; Directional derivative; Divergence; Solenoidal vector; Curl of a vector; Irrotational vector.

| **Unit 4** | **VECTOR INTEGRATION** | **8 hr** |
|---|---|---|

Line integral; Circulation; Work done; Surface integral; Volume integral; Green's theorem; Gauss divergence theorem; Stokes theorem (without proofs).

| **Unit 5** | **PARTIAL DIFFERENTIAL EQUATIONS (PDE)** | **8 hr** |
|---|---|---|

Formation of PDE (Eliminating arbitrary constants); Formation of PDE (Eliminating arbitrary functions); Lagrange's Linear PDE-1; Lagrange's Linear PDE-2; Homogeneous Linear PDE; Homogeneous Linear PDE ($e^{ax+by}$); Homogeneous Linear PDE ($sin$ or $cos$ $(ax+by)$); Homogeneous Linear PDE ($x^m\, y^n$).

LEARNING RESOURCES

**TEXT BOOKS:**


| | |
|---|---|
| 1 | B.S. Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, 2017. |
| 2 | T.K.V. Iyengar et al., *Engineering Mathematics*, S. Chand Publishers, Revised edition. |

| REFERENCE BOOKS: | |
|---|---|
| 1 | Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2011. |
| 2 | B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010. |
| 3 | T. Veerarajan, *Higher Engineering Mathematics*, Tata McGraw-Hill, 2008. |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL 6 | x | | | | |
| CO2 | BL 5 | | x | | | |
| CO3 | BL 3 | | | x | | |
| CO4 | BL 6 | | | | x | |
| CO5 | BL 3 | | | | | x |
| CO6 | BL 6 | x | x | x | x | x |

| R26MCHYT001 | CHEMISTRY | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | **42 (L)** | **L** | **T** | **P** | **C** |
| | Pre-requisite | Basics of 10 + 2 Chemistry | **3** | **0** | **0** | **3** |

**Course Objectives**

This course aims to help students

- To gain a comprehensive understanding of polymers and green chemistry
- To gain knowledge in electrochemistry, spectroscopic techniques and molecular machines.
- To get insight into phenomena of material deterioration and develop understanding on control and protective techniques.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| **CO - 1** | Apply knowledge of macromolecules such as polymers and rubbers to select and use suitable materials for engineering applications with improved properties. **(BL – 3)** |
| **CO - 2** | Choose certain spectroscopic techniques for analysis of compounds and explain the behaviour of materials as molecular switches. **(BL – 5)** |
| **CO - 3** | Apply fundamentals of electrochemistry and electro analytical techniques and determine a suitable storage device for desired engineering applications. **(BL – 3)** |
| **CO - 4** | Classify various types of material deterioration phenomena and identify suitable control and protective techniques. **(BL – 4)** |
| **CO - 5** | Explain the principles of green chemistry and develop understanding on nanomaterials and harnessing of solar energy. **(BL – 5)** |
| **CO - 6** | Choose suitable material, analytical technique for identification, analysis and develop an understanding on material use, protection and energy storage. **(BL – 6)** |

| **Unit 1** | **HIGH POLYMERS** | **8 hr** |
|---|---|---|

- Introduction– Types of Polymers – Degree of Polymerization – Functionality-Tacticity, Stereospecific Polymers.
- Types of Polymerizations – Addition – Condensation – Copolymerization and Co-ordination polymerization - Mechanism.
- Plastics – Properties - Types - Thermoplastics – Thermosets – with examples – Differences.
- Preparation, Properties and Applications of –PVC - Teflon – Bakelite – Nylon.
- Rubbers – Natural - Synthetic – Properties of natural rubber – Vulcanization.
- Preparation, properties and applications of - BUNA – S, BUNA - N.
- Fiber Reinforced Plastics - Introduction – Need for reinforcement – Types of FRP – Aramids – Kevlar and Nomex – Preparation and applications.
- Conducting polymers - Introduction – Classification – Intrinsic and extrinsic – Applications.

| **Unit 2** | **SPECTROSCOPY AND MOLECULAR SWITCHES** | **8 hr** |
|---|---|---|

- Introduction to spectroscopy - Electromagnetic radiation - Electromagnetic spectrum – Molecular energies and its order.
- Classification – Absorption and Emission spectroscopy.
- Laws of Absorption – Derivation of Beer – Lambert's law – Significance.
- UV – Visible Spectroscopy - 1 – Introduction to UV – Visible Spectroscopy –

Principle involved UV – Visible Spectroscopy.

- UV – Visible Spectroscopy – 2 - Instrumentation (block diagram) – Applications of UV – Visible Spectroscopy.
- Infra – Red Spectroscopy - 1 – Introduction to Infra - Red Spectroscopy – Principle involved in Infra – Red spectroscopy.
- Infra – Red Spectroscopy – 2 - Instrumentation (block diagram) – Applications of Infra – Red Spectroscopy.
- Molecular switches – logic gate operators – Molecular switch as NOR and NOT logic gate operators – Molecular motors – Definition – Natural – Artificial – Rotaxanes and Catenanes – Definitions and Applications.

| **Unit 3** | **ELECTROCHEMISTRY AND ITS APPLICATIONS** | **8 hr** |
|---|---|---|

- Introduction - Electrode Potential – Measurement of electrode potential using SHE - Electrochemical series.
- Expression for electrode potential – Electrochemical cell – EMF of the cell – Problems related to Nernst equation.
- Reference electrodes – Hydrogen electrode – Metal – Metal ion electrode – calomel electrode.
- Storage devices – Classification – Primary – Leclanché cell.
- Secondary - Solid state battery / Lithium-ion battery.
- Flow Cells - Fuel cells – Hydrogen – Oxygen fuel cell, Methanol – Oxygen fuel cell.
- Conductivity of electrolytes – Specific conductance – Equivalent conductance – Molar Conductance – Degree of Ionization - Kohlrausch's law
- Conductometry - Principle – Applications.

| **Unit 4** | **Corrosion** | **8 hr** |
|---|---|---|

- Introduction – Theories of Corrosion - Dry Corrosion – Mechanism.
- Wet Corrosion – Mechanism.
- Galvanic series - Types of Corrosion - Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion.
- Factors influencing rate of corrosion - Metal-based factors and Environment based factors.
- Corrosion control Methods - Proper design, Use of Pure metal, Use of Alloy.
- Cathodic protection – Sacrificial Anodic protection. method – Impressed current cathodic protection method- Use of Inhibitors.
- Protective coatings - Definition - Metal Coatings – Anodic - Galvanizing and Cathodic Coating – Tinning.
- Passivation and Pourbaix diagram.

| **Unit 5** | **Concepts of Green Chemistry, Nano Chemistry and Solar Energy** | **8 hr** |
|---|---|---|

- Green Chemistry - Introduction - Principles of Green Chemistry.
- Microwave assisted method – Ultrasound assisted method reactions - Applications of green chemistry.
- Nanomaterials - Introduction – Classification of Nano materials.
- Synthesis of Nano material by Top down and bottom-up approach - CVD Method.
- Sol gel method – Synthesis of iron oxide nano particles.
- Carbon nano tubes – Introduction - Classification – Applications.
- Harnessing of Solar Energy – Construction and Working of PV Cell.
- Solar collectors – Concentrating.

| LEARNING RESOURCES | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Jain and Jain, **Engineering Chemistry**, 17th ed. New Delhi, India: Dhanpat Rai Publications, 2015. |
| 2 | S.S. Dara, **Text Book of Engineering Chemistry**, 12th ed. New Delhi, India: S. Chand, 2006. |
| 3 | Y. Bharathi Kumari, **Text Book of Engineering Chemistry**, For JNTU R23 Hyderabad, India: VGS Publications, 2023 |
| **REFERENCE BOOKS:** | |
| 1 | T. F. Yen, **Chemistry for Engineers**. London, U.K.: Imperial College Press, 2008. |
| 2 | S. K. Chawla, **Engineering Chemistry**, latest ed. New Delhi, India: Dhanpat Rai & Co., 2017 |

**COs and Unit Catchment matrix**

| CO | Blooms levels | Unit - 1 | Unit - 2 | Unit - 3 | Unit - 4 | Unit - 5 |
|---|---|---|---|---|---|---|
| **CO – 1** | **BL – 3** | × | | | | |
| **CO – 2** | **BL - 5** | | × | | | |
| **CO – 3** | **BL - 3** | | | × | | |
| **CO – 4** | **BL - 4** | | | | × | |
| **CO - 5** | **BL - 5** | | | | | × |
| **CO - 6** | **BL - 6** | × | × | × | × | × |

| R26MCIVT001 | ENVIRONMENTAL STUDIES | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28(L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | NIL | **2** | **0** | **0** | **2** |

**Course Objective**

This course aims to impart a deep understanding of environmental processes, climate change, biodiversity, ecosystem functionality, and lifestyle impacts. Equipped with this knowledge, students will advocate for climate mitigation and combat climate change effectively.

**Course Outcomes:** After completing this course, the students will be able to Apply and Articulate

| | |
|---|---|
| 1 | The importance of biodiversity, ecosystem functionality, natural resources, pollution control, and environmental sustainability. **(BL3)** |
| 2 | The principles governing Earth's climate system, including energy balance, atmospheric composition, greenhouse effect, and atmospheric circulation. **(BL3)** |
| 3 | The interactions among the carbon cycle, water cycle, oceans, cryosphere, and biosphere in regulating Earth's climate system. **(BL3)** |
| 4 | Climate variability, feedback mechanisms, extreme weather events, and governance approaches for addressing climate change. (**BL3**) |
| 5 | Sustainable practices such as energy and water conservation to promote environmental protection and resource efficiency. **(BL3)** |

**SYLLABUS**

| **Unit I** | **ENVIRONMENT AND SUSTAINABILITY** | **5 hr** |
|---|---|---|

Biodiversity and ecosystem functionality; Natural resources; Environmental pollution; Source-Transport-Receptor Concept; Environmental episodes.

| **Unit II** | **HOW EARTH'S CLIMATE WORKS** | **5 hr** |
|---|---|---|

Earth’s Energy Balance; Composition of the Atmosphere and Earth’s climate system; Greenhouse Gas effect; Atmospheric Motion; Weather and Climate.

| **Unit III** | **EARTH SYSTEM INTERACTIONS AND CLIMATE REGULATION** | **5 hr** |
|---|---|---|

Carbon Cycle; Water Cycle; Ocean Climate Interactions; Cryosphere Dynamics; Biosphere and Climate Regulation.

| **Unit IV** | **UNDERSTANDING CLIMATE CHANGE AND RESPONSES** | **5 hr** |
|---|---|---|

Paleoclimate and Natural Climate Variability; Climate Feedback Mechanisms; Case Studies of Extreme Weather Events; Climate Governance and Justice; Success Stories in Climate Change Response.

| **Unit V** | **SUSTAINABLE LIFESTYLES FOR THE FUTURE** | **5 hr** |
|---|---|---|

Sustainability Challenges; Save Energy; Save Water; Reduce waste; Healthy Lifestyles.

**LEARNING RESOURCES**

**TEXTBOOKS:**


| | |
|---|---|
| 1 | E. Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, 2nd ed. Hyderabad, India: Universities Press, 2012. |
| 2 | J.K. Arora, B.K. Tyagi, K.S. Bath, R. Bal, and S.S. Ladhar, *Activity Book on Climate Change*. Punjab State Council for Science & Technology, 2022. |


**REFERENCE BOOKS:**


| | |
|---|---|
| 1 | R. T. Wright and D. F. Boorse, *Environmental Science: Toward a Sustainable Future*, 13th ed. Boston, MA: Pearson, 2017. |
| 2 | United Nations Development Programme, *Climate Box. An interactive* |

| | |
|---|---|
| | *learning toolkit on climate change*. New York, NY, 2018. |
| **ADDITIONAL REFERENCE MATERIAL** | |
| 1 | https://missionlife-moefcc.nic.in/Download-Creatives-Save-Energy.php?id=MTE= |
| **ONLINE COURSES** | |
| 1 | https://enterprise.edx.org/APSCHE/program/df4909e1-a837-4c49-b575-a909c3990bf8/progress |

**BLOOM'S LEVEL - UNITS CATCHMENT ARTICULATION MATRIX**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| **CO1** | BL3 | X | | | | |
| **CO2** | BL3 | | X | | | |
| **CO3** | BL3 | | | X | | |
| **CO4** | BL3 | | | | X | |
| **CO5** | BL3 | | | | | X |

| R26MENGT001 | VERBAL COMMUNICATION SKILLS | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | ….. | **2** | **0** | **0** | **2** |

**Course Objective**

The course facilitates a platform for the students to explore the nuances of speaking, practice articulation and equips them with the skill of constructive oral presentation.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Demonstrate the ability to talk about oneself and narrate personal experiences clearly. **BL-3** |
| 2 | Demonstrate the ability to interpret ideas and express one's viewpoints clearly. **BL-3** |
| 3 | Demonstrate the ability to communicate professionally in a persuasive manner. **BL-3** |
| 4 | Demonstrate the ability to pitch an idea and collaborate in a team to arrive at a consensus. **BL-3** |
| 5 | Demonstrate the ability to construct, defend arguments respectfully. **BL-3** |

**SYLLABUS**

| **Unit I** | **SHARING IDEAS & EXPERIENCES** | **5 hrs** |
|---|---|---|

**Personal Storytelling**

- An ideal day in my life.
- My favorite recipe and experiences associated with it

**Innovation and communication-**

Visualizing a gadget of the future and narrating how it solves a current problem of the world.

**Clarity and presentation** –

If your life has to be documented as a film, which aspect of your personality you want to be highlighted? Describe intricately how the trailer would be.

(Focus: Small and intricate things that make big difference in marketing the documentary/film)

**Career awareness**: Discussion on 'Skills needed to get placed in an MNC and a skill that I need to master.

**Critical reflection**: Discussion on 'Do we fear failure more than we desire success?

| **Unit II** | **SHARING REFLECTIONS** | **5 hrs** |
|---|---|---|

**Interpretating an idea**– Interpretating a line from a book or film.

**Self-analysis:** How do I consider myself as a unique person in the world.

**Defining myself**: A statement that I would like to make regarding life in general and how I substantiate it.

**Reflective thinking**: Discussion on 'One life lesson that I wish to share with you.

**Persuasive Storytelling**: Discussion on 'The most inspirational personality in my life and how I wish to emulate him/her in contributing to the world of engineering.

| **Unit III** | **THE SKILL OF PERSUASION -1** | **5 hrs** |
|---|---|---|

**Self- Introduction** – Presenting oneself in an interview.

**Visualization and presentation** – How I visualize myself after 15 years from now. (Professional and personal fronts)

| | | |
|---|---|---|
| **Self-Marketing** - My understanding of the job market and how I market myself in it.<br>**Global issues & awareness:** Discussion on 'engineering solutions to real - world problems in the 21st Century.'<br>**Relevance of reskilling**: Discussion on 'how I wish to reskill to stay relevant in the world of technology' | | |
| **Unit IV** | **THE SKILL OF PERSUASION -2** | **5 hrs** |
| **Values & assessment** – If you get powers to change one bad thing in the world, what would it be and why?<br>**Self-evaluation** – What is my dream job and If I have to rate myself as an eligible aspirant for my dream job, how would I do it on a scale of 10?<br>**Pitching an idea-** One idea to contribute to sustainable living<br>**Collaboration and communication**: Discussion on, 'Good teamwork & success'/One quotation on teamwork that I like the most'<br>**Persuasive presentation**: Discussion on 'Technology and environmental protection – How should they go together? | | |
| **Unit V** | **MAKING AN ARGUMENT** | **5 hrs** |
| **Knowing my dream company:** What I know about my dream company?<br>**Career Goal**: How I wish to be self-reliant in the coming 5 years.<br>**Constructive Argumentation** – Theory and practice of debating.<br>**Persuasive Communication** – Mastering tone, evidence, and rebuttal.<br>**Debate on topics related to ethics** –<br>• Should even active euthanasia be made legal in India?<br>• Privacy of citizens or security of the nation: which should be prioritized first?<br>**Debate on a topic related to Societal Responsibility**:<br>• Should an engineer prioritize industrial development or ecological responsibility?<br>**Debate on a topic related to Personal Development:**<br>• Summer break- Is it only for relaxation or is it also for upskilling oneself? | | |
| LEARNING RESOURCES | | |
| **REFERENCE BOOKS** | | |
| 1 | Seely, John. *Oxford guide to effective Writing and Speaking*. Oxford Press. 2022. | |
| 2. | Atkins, Ros. *The art of explanation.* Wildfire publications. 2023 | |
| **WEB RESOURCES** | | |
| 1 | www.purdueowl.com<br>www.voanews.com<br>www.learningenglish.vn<br>www.prowritingaid.com<br>www.eslcafe.com<br>www.5minutesenglish.com<br>www.livinglanguage.com | |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL3 | X | | | | |
| CO2 | BL3 | | X | | | |
| CO3 | BL3 | | | X | | |
| CO4 | BL3 | | | | X | |
| CO5 | BL3 | | | | | X |

| R26MENGT004 | ETHICS AND HUMAN VALUES | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | ….. | **2** | **0** | **0** | **2** |

**Course Objective**

The course creates awareness of the need for a holistic perspective in understanding the ethical challenges in the engineering profession. It enables the student to better appreciate the need and relevance of important human values that form the fabric of the engineer's approach to facing such challenges, both at a personal and organizational level

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Demonstrate the understanding of the relevance and scope of ethics in the engineering profession (**BL 3**) |
| 2 | Demonstrate understanding of the relevance of ethical theories and their applications in societal living. (**BL3**) |
| 3 | Demonstrate understanding of ethical issues arising out of the engineering profession being social experimentation (**BL 3)** |
| 4 | Demonstrate understanding of ethical considerations in the corporate world **(BL 3)** |
| 5 | Demonstrate understanding of ethical considerations in the context of global issues (**BL 3)** |

**SYLLABUS**

| **Unit I** | **SCOPE OF ENGINEERING ETHICS** | **5 hrs** |
|---|---|---|

Introduction to Ethics and Professionalism; Responsibility; Responsible Professionals and Corporations; Resolving Ethical Dilemmas; Making Moral Choices;

| **Unit II** | **THEORIES OF ETHICS** | **5 hrs** |
|---|---|---|

Utilitarianism; Rights Ethics and Duty Ethics; Virtue Ethics; Ethical Egoism; Motives of Engineers;

| **Unit III** | **ENGINEERING AS SOCIAL EXPERIMENTATION** | **5 hrs** |
|---|---|---|

Similarities With Standard Experimentation; Contrast with Standard Experimentation; Engineers as Responsible Experimenters; Acceptability of Risk; Assessing and Reducing Risk;

| **Unit IV** | **CORPORATE ETHICS** | **5 hrs** |
|---|---|---|

Teamwork and Ethics; Conflict of Interest; Rights of Engineers; Whistleblowing; Truthfulness

| **Unit V** | **ETHICS AND GLOBAL CONTEXTS** | **5 hrs** |
|---|---|---|

Environmental Ethics; Multinational Corporations and Ethical Issues; Computer Ethics – 1; Computer Ethics – 2; Weapons Development and Ethics;

LEARNING RESOURCES

**TEXTBOOKS:**

| | |
|---|---|
| 1 | M. W. Martin and R. Shinzinger, "Ethics in Engineering", Fourth Edition, McGraw Hill 2005 |

**REFERENCE BOOKS:**

| | |
|---|---|
| 1 | C. E. Harris, M. S. Pritchard, R. W. James, E. E. Englehardt and M. J. Rabins, "Engineering Ethics: Concepts and Cases", Sixth Edition, Cengage, 2019 |
| 2 | Charles D. Fleddermann, "*Engineering Ethics*", Pearson Education / Prentice Hall, New Jersey, 2004 |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL3 | X | | | | |
| CO2 | BL3 | | X | | | |
| CO3 | BL3 | | | X | | |
| CO4 | BL3 | | | | X | |
| CO5 | BL3 | | | | | X |

| R26MCHYL001 | CHEMISTRY LAB | | | | | |
|---|---|---|---|---|---|---|
| | **Total Contact Hours** | **28 (P)** | **L** | **T** | **P** | **C** |
| | **Pre-requisite** | **Basics of 10 + 2 Chemistry** | **0** | **0** | **2** | **1** |

**Course Objective:** This course aims to help students

- To verify the fundamental concepts with experiments

**Course Outcomes:** After completing this course, the students will be able to

| | |
|---|---|
| **1** | Determine total hardness, strength of acid in a lead acid battery, using volumetric analysis |
| **2** | Demonstrate conductometric, potentiometric, pH metric titrations and colorimetric determinations. |
| **3** | Design an experimental procedure and carryout the same using virtual platforms. |

**List of Experiments**

1. Determination of HCl using sodium carbonate.
2. Determination of Strength of an acid in Pb-Acid battery.
3. Determination of Iron (II) using potassium dichromate.
4. Determination of Hardness of a groundwater sample.
5. Potentiometric titration of Fe (II) with potassium dichromate.
6. Condcutometric titration of Strong acid VS Strong base.
7. pH metric titration of strong acid and strong base.
8. Determination of percentage of Iron in Cement sample by colorimetry.
9. Green synthetic approach for synthesis of esters using ultra sonic method.
10. Design experiment – 1.

**Additional Experiments**

1. Preparation of Bakelite.
2. Determination of dissolved oxygen in water sample by Winkler's method.

**Advanced Design Experiments**

1. Determination of viscosity of polymer solution using survismeter.
2. Measurement of 10Dq by spectrophotometric method.

**TEXTBOOKS**


1. A.I. Vogel, "Quantitative Chemical Analysis," 6th ed. Boston, MA, USA: Cengage Learning, 2000.
2. D. A. Day and A. L. Underwood, Quantitative Chemical Analysis. Upper Saddle River, NJ, USA: Prentice Hall, 1991.
3. K. Mukkanti, Practical Engineering Chemistry. Hyderabad, India: B.S. Publications, 2009.


**REFERENCE BOOKS:**


1. J. Cherukuri, Laboratory Manual of Engineering Chemistry-II, VGS Techno Series, 2012.
2. Department of Chemistry, MVGR College of Engineering, Laboratory Manual.

| R26MSCSL001 | OFFICE TOOLS & SOCIAL MEDIA ETIQUETTE | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28 (P) | **L** | **T** | **P** | **C** |
| | Pre-requisite | - | **0** | **0** | **3** | **2** |

**Course Objective**

- To get hands-on exposure to office automation software.
- To perform basic data analysis tasks using spreadsheets.
- To practice methods of social media etiquette and digital wellbeing.

**Course Outcomes**:
After completing this course, the students will be able to

| | |
|---|---|
| 1 | Create documents and letters for professional communication. |
| 2 | Analyze and interpret data and provide effective visualization. |
| 3 | Create presentations and slideshows. |
| 4 | Practice various mechanisms of social media etiquette. |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Create a simple document containing tables, images, smart art and flowchart symbols. Apply various font styles, sizes, designs, bullet points and page layouts. |
| 2 | Create a document containing hyperlinks, equations, symbols and charts. Apply various header and footer formats, bookmarks and macros. |
| 3 | Create a document with citations, bibliography, table of figures, cross-reference and index. |
| 4 | Create a simple presentation with various layouts, background design, fonts and geometric shapes with different effects |
| 5 | Create a presentation with transitions, animations with timings and audio files. |
| 6 | Create a presentation with hyperlinks to internal slides, external files and language translator. |
| 7 | Create a spreadsheet using numerical data and perform various mathematical, statistical and engineering operations using built-in formulae. |
| 8 | Create a spreadsheet using text data and perform Text operations like search, replace, concatenate, trim etc.; use Date format to perform various Date & Time operations. |
| 9 | Create a spreadsheet using numerical data which is imported from real time datasets and perform visualization using graphs, pivot charts etc. |
| 10 | Create a spreadsheet using all available data formats and perform data migration, validation and consolidation. |
| 11 | Create digital profile on LinkedIn and observe patterns of a professional profile. Follow influential people from technology and software domain. |
| 12 | Create a social media profile on any latest platform following social media etiquette and mark a professional digital footprint. |

**LEARNING RESOURCES**

**ONLINE COURSES**

| | |
|---|---|
| 1 | https://books.libreoffice.org/en/ |
| 2 | https://www.w3schools.com/googlesheets/ |
| 3 | https://support.microsoft.com/en-us/training |
| 4 | https://www.office.com/ |
| 5 | https://www.google.com/docs/about/ |
| 6 | https://workspace.google.com/products/sheets/ |
| 7 | https://in.linkedin.com/ |
| 8 | https://www.rd.com/list/social-media-etiquette/ |

| R26MMECW001 | ENGINEERING WORKSHOP | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 14 (L) + 28(P) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Nil | **1** | **0** | **2** | **2** |

**Course Objective**

To familiarize students with different useful trades widely used in day- today practice.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Identify various trades and perform related work at a preliminary level. |
| 2 | Select and use proper tools for the different tasks |
| 3 | Address troubleshoots in real-life and get rid of dependency. |
| 4 | Ability to design and model different prototypes using different trades |
| 5 | Demonstrate the safety practices to be applied on different trades |
| Module 1 | **Carpentry shop**<br>1.1. Introduction to various types of wood such as Teak, Mango, Sheesham, etc. (Demonstration and their identification).<br>1.2. Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed. Job I Marking, sawing, planning and chiselling & their practice<br>1.3. Introduction to various types of wooden joints, their relative advantages and uses. Preparation of half lap joint, Preparation of Mortise and Tenon Joint<br>1.4.Safety precautions in carpentry shop.<br>1.5 Hands on experience in carpentry for making duster.<br>1.6 Hands on experience in carpentry for making day-today used products and wood requirement. |
| Module 2 | **Plumbing:**<br>2.1. Introduction to plumbing tools, common materials used in plumbing.<br>2.2. Description and demonstration of simple operations in plumbing<br>2.3.Care, Safety precautions and maintenance of plumbing tools and setup.<br>2.4 Design a plumbing layout for domestic applications.<br>2.5 Address trouble shootings in basic plumbing emergencies.(Spindle replacement in taps, water tap replacement, leakage of a tap) |
| Module 3 | **House wiring – 3**<br>3.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVC Conduits.<br>3.2 Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthing.<br>3.3 Selection of wires (color code) and identification of electrical components in house hold.<br>3.4 House wiring for specific requirement from main panel and usage of multimeter.<br>3.5 Load calculation given connected utilities and cost estimation |
| Module 4 | **Fabrication – 4:**<br>4.1 Introduction to welding<br>4.2. Description about fabrication peripherals such as protection shield, welding machine types, electrode nomenclature. |

| | |
|---|---|
| | 4.3. Safety measures in welding practice<br>4.4 Fabrication of an useful component/ product using different weld joints. |
| Module 5 | **Assembly and Disassembly:**<br>5.1 Introduction to machine parts, tools and accessories used for assembly and disassembly of a machine<br>5.2. Functions of all parts and their importance<br>5.3 Care and safety precautions during the work.<br>5.4 Assembly and disassembly of automobile (Replacement of vehicle tyre)<br>5.5 Assembly and disassembly of mechanical unit (machine). |
| **LEARNING RESOURCES** | |
| **TEXT BOOKS:** | |
| 1 | K.C. John, *Mechanical workshop practice*, second edition, PHI learning, 2010. |
| 2 | Bruce J. Black, *Workshop Processes, Practices and Materials*, Routledge publishers, 5th Edn. 2015. |
| 3 | B.S. Raghuwanshi, *A Course in Workshop Technology Vol I. & II,* , Dhanpath Rai & Co., 2015 & 2017. |
| **REFERENCE BOOKS:** | |
| 1 | S. K. Hajra Choudhury, Hajra Choudhury, A K, Roy, Nirjhar, Bhattacharya, S C. *Elements of Workshop Technology, Vol. I*, 14th edition, Media Promoters and Publishers, Mumbai. 2007. |
| 2 | H. S. Bawa, *Workshop Practice*, Tata-McGraw Hill, 2004. |
| 3 | Soni P.M. & Upadhyay P.A, *Wiring Estimating, Costing and Contracting;* Atul Prakashan, 2021. |
| **ADDITIONAL REFERENCE MATERIAL** | |
| 1 | https://mrcet.com/downloads/hs/EWS-ITWS%20%20LAB%20MANUAL.pdf |
| 2 | https://sjce.ac.in/wp-content/uploads/2018/04/Workshop-Laboratory-Manual.pdf |
| 3 | https://manavrachna.edu.in/latest/virtual-lab-workshop-for-first-year-engineering-students-mru/ |

| R26MMATT003 | PROBABILITY & STATISTICS AND NUMERICAL METHODS (CIV, MEC & CHE) | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 40 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Basic calculus and probability | **3** | **0** | **0** | **3** |

**Course Objective**

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Analyze and comprehend the properties of different statistical distributions. (**BL4**) |
| 2 | Utilize statistical techniques to analyze bivariate data. (**BL3**) |
| 3 | Test a hypothesis concerning means and proportions for large samples. (**BL6**) |
| 4 | Solve algebraic and transcendental equations and use numerical techniques for interpolation. (**BL3**) |
| 5 | Apply Numerical methods to solve initial value problems and do numerical integration. (**BL3**) |
| 6 | Formulate Mathematical models and estimate appropriate physical quantities. (**BL6**) |

**SYLLABUS**

| **Unit 1** | **RANDOM VARIABLES & PROBABILITY DISTRIBUTIONS** | **8 hr** |
|---|---|---|

Discrete Random Variable; Discrete Probability Distribution; Expectation of Discrete random variable; Continuous random variable; Continuous probability distribution; Normal distribution; Probabilities of normal variable; Parameters of normal variable.

| **Unit 2** | **STATISTICAL METHODS** | **8 hr** |
|---|---|---|

Fitting of Linear Curve-1; Fitting of Linear Curve-2; Fitting of Parabola; Fitting of Exponential Curve; Fitting of Power Curve; Correlation-1; Correlation-2; Regression.

| **Unit 3** | **SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS (LARGE SAMPLES)** | **8 hr** |
|---|---|---|

Sampling Distribution of Means with replacement; Sampling Distribution of Means without replacement; Confidence interval for means; Confidence interval for proportions; Testing of Hypothesis for single mean; Testing of Hypothesis for two means; Testing of Hypothesis for single proportion; Testing of Hypothesis for two proportions.

| **Unit 4** | **NUMERICAL METHODS-1** | **8 hr** |
|---|---|---|

Bisection Method; Regula-Falsi Method; Newton-Raphson Method; Finite Differences and Symbolic operations; Newton Forward interpolation-1; Newton Forward interpolation-2; Newton Backward interpolation; Lagrange's interpolation.

| **Unit 5** | **NUMERICAL METHODS-2** | **8 hr** |
|---|---|---|

Trapezoidal rule-1; Trapezoidal rule-2; Simpson's 1/3 rule; Simpson's 3/8 rule; Taylor's Series method; Euler's method; Runge-Kutta method of $2^{nd}$ order; RK method of $4^{th}$ order.

LEARNING RESOURCES

**TEXT BOOKS:**


| | |
|---|---|
| 1 | R.E. Walpole, S.L. Myers & K. Ye, *Probability and Statistics for Engineers & Scientists*, 3/e, Pearson Publishers. |
| 2 | T.K.V. Iyengar et al., *Probability and Statistics*, S. Chand Publications, Revised edition. |
| 3 | B.S. Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, |

| | |
|---|---|
| | 2017. |
| | |
| **REFERENCE BOOKS:** | |
| 1 | Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2011. |
| 2 | B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010. |
| 3 | T. Veerarajan, *Higher Engineering Mathematics*, Tata McGraw-Hill, 2008. |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL 4 | x | | | | |
| CO2 | BL 3 | | x | | | |
| CO3 | BL 6 | | | x | | |
| CO4 | BL 3 | | | | x | |
| CO5 | BL 3 | | | | | x |
| CO6 | BL 6 | x | x | x | x | x |

| R26MPHYT001 | PHYSICS | | | | | |
|---|---|---|---|---|---|---|
| | **TOTAL CONTACT HOURS** | 42 | **L** | **T** | **P** | **C** |
| | **PRE-REQUISITE** | Higher Secondary School Physics | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVE:**

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by introducing the freshman engineering students to domains like crystallography, magneto-dielectric materials, wave phenomena of light, coherent optics, quantum etiquettes, and semiconductors.

**COURSE OUTCOMES:**

| | | |
|---|---|---|
| **CO1** | **Identify** the crystallographic phase of the specimen by employing X-ray diffraction. | **BL3** |
| **CO2** | **Illustrate** the dielectric polarization mechanisms and **choose** the magnetic material for an intended application. | **BL3** |
| **CO3** | **Interpret** the intensity variation of light due to interference, diffraction and polarization phenomena. | **BL3** |
| **CO4** | **Apply** the principles of laser technology to solve problems concerning optical gain and population inversion; and **identify** the optic fiber type for projected communication requirements. | **BL3** |
| **CO5** | **Solve** the Schrodinger equation for quantum wells and barriers; and to **ascertain** the nature of semiconductor type by using Hall effect. | **BL3** |
| **CO6** | **Elaborate** the structural, magnetic, and dielectric behaviors of materials; the optical phenomena and the working principles of photonic tools; the quantum behavior at atomic scales and the essentials of semiconductor. | **BL6** |

**SYLLABUS:**

| **UNIT I** | **CRYSTAL PHYSICS** | **8 hrs** |
|---|---|---|

Space Lattice- Unit cell- Crystal systems; Bravais lattices; Atomic packing fraction- Simple Cubic- BCC- FCC structures; Diamond cubic structure- Calculation of lattice constant; Crystal planes- Directions- Miller indices; Distance between successive h k l planes; X-ray Diffraction- Bragg's law; Powder X-ray diffraction method- Applications.

| **UNIT II** | **MAGNETIC AND DIELECTRIC MATERIALS** | **8 hrs** |
|---|---|---|

Magnetic dipole moment – Permeability- Magnetization- Atomic origin of magnetism; Dia, Para, Ferro, Anti-ferro and Ferrimagnetic materials; Hysteresis- Soft and Hard magnetic materials; Dielectric constant- Displacement Vector- Dielectric polarization – Relation between the electric vectors; Electronic polarization; Ionic polarization- Orientation polarization (Qualitative); Internal field in dielectrics; Clasius-Mossotti relation in dielectrics;

| **UNIT III** | **WAVE OPTICS** | **8 hrs** |
|---|---|---|

Principle of Superposition- Theory of interference fringes; Interference in thin film- Cosine law; Newton's rings-Applications; Diffraction at a single slit- Intensity distribution; Diffraction at N-parallel slits; Polarization by reflection- Brewester's law; Double refraction; Quarter and Half wave plates

| UNIT IV | PHOTONICS | 8 hrs |
|---|---|---|
| Absorption, Spontaneous and Stimulated emission of radiation; Einstein coefficients- Relation between the coefficients; Laser- Characteristics- Applications; Population inversion (3-level)- Components of laser system; Ruby laser- Construction- Working- Advantages; Optic fiber- Principle- Components of fiber; Numerical aperture- Acceptance angle- Acceptance cone; Classification of optic fiber- Step Index- Graded Index fibers. | | |
| **UNIT V** | **QUANTUM PHYSICS AND SEMICONDUCTORS** | **8 hrs** |
| Matter Wave- de Broglie wavelength of matter wave; Uncertainty principle- Wave function- Physical significance; Schrodinger Time-independent wave equation; Particle in a 1D potential box- Energies and Wave functions; Fermi-Dirac distribution function- Distinction between metals, insulators and semiconductors; Intrinsic semiconductors- Carrier concentration- Fermi level; Extrinsic semiconductors- Carrier concentration; Hall effect | | |

**ARNING RESOURCES**

| | |
|---|---|
| **TEXTBOOKS:** | |
| 1 | B.K. Pandey and S. Chaturvedi, *Engineering Physics*, 2nd Edition, Cengage Learning, 2021. |
| 2 | M. N. Avadhanulu, P.G.Kshirsagar and TVS Arun Murthy, *A Text book of Engineering Physics*, 11th Edition, S.Chand Publications, 2019. |
| **REFERENCE BOOKS:** | |
| 1 | Hitendra K. Malik and A.K. Singh, *Engineering Physics*, Second edition, Mc. Graw Hill Publishers, 2017. |
| 2 | M.R. Srinivasan, *Engineering Physics,* 2nd Edition, New Age International Publishers, 2021. |
| 3 | Shatendra Sharma and Jyotsna Sharma, *Engineering Physics*, 1st Edition, Pearson Education, 2018. |
| **ADDITIONAL REFERENCE MATERIAL:** | |
| 1 | https://www.youtube.com/watch?v=GQ5XpeS3e3U&list=PLLy_2iUCG87B_Tmfs0y2tR8GNIkyRIKpW |
| 2 | https://archive.nptel.ac.in/courses/112/106/112106227/ |
| 3 | https://archive.nptel.ac.in/courses/122/107/122107035/ |
| 4 | https://archive.nptel.ac.in/courses/104/104/104104085/<br>https://archive.nptel.ac.in/courses/115/107/115107095/ |
| 5 | https://archive.nptel.ac.in/courses/115/101/115101107/<br>https://archive.nptel.ac.in/courses/108/108/108108122/ |

**BLOOM'S LEVEL - UNITS CATCHMENT ARTICULATION MATRIX**

| CO | Blooms Level | Unit-1 | Unit-2 | Unit-3 | Unit-4 | Unit-5 |
|---|---|---|---|---|---|---|
| CO1 | BL3 | X | | | | |
| CO2 | BL3 | | X | | | |
| CO3 | BL3 | | | X | | |
| CO4 | BL3 | | | | X | |
| CO5 | BL3 | | | | | X |
| CO6 | BL6 | X | X | X | X | X |

| R26MCHET001 | INTRODUCTION TO CHEMICAL ENGINEERING | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 42 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Nil | **3** | **0** | **0** | **3** |

**Course Objectives:**

Students will get familiarized with the scope and importance of Chemical Engineering in process industries and everyday life. They learn the fundamentals of Chemical Engineering such as unit operations and unit processes in Chemical industries.

**Course Outcomes**

Student will be able to,

| | |
|---|---|
| 1 | Analyze the scope and applications of Chemical Engineering, distinguish between unit operations and unit processes, and interpret the role of material and energy balances in chemical process industries. (BL4) |
| 2 | **Illustrate the basic principles of mechanical operations and fluid flow, and select suitable equipment for handling and processing fluids and solids in chemical industries. (BL3)** |
| 3 | **Illustrate the basic mechanisms of heat transfer and explain the working and applications of heat exchange and evaporation equipment used in chemical process industries. (BL3)** |
| 4 | **Illustrate the basic principles of major mass transfer operations and select suitable separation processes for different chemical engineering applications. (BL3)** |
| 5 | **Analyze the factors influencing the rate of chemical reactions and differentiate various types of reactions and reactors used in chemical process industries. (BL4)** |
| 6 | Develop a conceptual chemical process by integrating the principles of major Chemical Engineering operations and processes. (BL6) |

**SYLLABUS**

| **Unit I** | **Basic Concepts and Introduction to Engineering Calculations** | **8 hr** |
|---|---|---|

**Basic Concepts**: Chemical Engineering in everyday, Applications of Chemical Engineering, Unit operations, Unit processes, Flow sheet types, Dimensionless quantities and its significance.

**Introduction to Engineering Calculations**: material balance with and without chemical reaction, energy balance.

| **Unit II** | **Introduction to Mechanical operations and Fluid Flow** | **8 hr** |
|---|---|---|

**Introduction to Mechanical operations**: principles of Size reduction, types of crushers & grinders, filtration, transportation and storage of solids.

**Fluid Flow**: Nature of the fluid, continuity equation, Bernoulli's equation, fluidization, fluid handling machinery, Relevance of mechanical unit operations and fluid mechanics in chemical engineering.

| **Unit III** | **Introduction to Process Heat Transfer** | **8 hr** |
|---|---|---|

**Introduction to Process Heat Transfer**: conduction, convection, radiation, overall heat transfer coefficient, heat exchange equipment: flow arrangements, double pipe heat exchanger, shell and tube heat exchanger, evaporation, relevance of heat transfer in chemical engineering.

| **Unit IV** | **Introduction to Mass transfer operations** | **8** |
|---|---|---|

| | | |
|---|---|---|
| | | **hr** |
| **Introduction to Mass transfer operations**: classification of mass transfer operations, molecular and bulk diffusion, choice of separation processes, basic principles and applications of absorption, distillation, adsorption, extraction and drying, relevance of mass transfer in chemical engineering. | | |
| **Unit V** | **Introduction to Reaction Engineering** | **8 hr** |
| **Introduction to Reaction Engineering**: Classification of reactions, variables affecting the rate of reaction, rate equation, molecularity and order of reaction, elementary and non-elementary reaction, concentration and temperature dependency of reaction rate, types of reactors, relevance of reaction engineering in chemical engineering. | | |
| **LEARNING RESOURCES** | | |
| **TEXT BOOKS:** | | |
| 1 | S. K. Ghosal, S. K. Sanyal and S. Dutta, Introduction to Chemical Engineering, Fourth edition, Tata McGraw-Hill, 1993 | |
| 2 | S. Pushpavanam, Introduction to Chemical Engineering, First edition, PHI, 2012 | |
| **REFERENCE BOOKS:** | | |
| 1 | W.L. McCabe, J.C. Smith and Peter Harriott, Unit operations in Chemical Engineering, Seventh Edition, McGraw Hill, 2005 | |
| 2 | Incropera, Dewitt, Bergman and Lavine, Principles of Heat and Mass Transfer, Global Edition, Wiley India Edition, 2017 | |
| 3 | Richard M. Felder and Ronald W. Rousseau, Elementary Principles of Chemical Processes, Fourth edition, John Wiley & Sons, INC., 2018 | |

**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO-1 | BL4 | X | | | | |
| CO-2 | BL3 | | X | | | |
| CO-3 | BL3 | | | X | | |
| CO-4 | BL3 | | | | X | |
| CO-5 | BL4 | | | | | X |
| CO-6 | BL6 | X | X | X | X | X |

| R26MSCST001 | PROCEDURAL PROGRAMMING | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 42 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | - | **3** | **0** | **0** | **3** |

**Course Objective**

To develop proficiency in procedural programming using C through fundamental concepts, control structures, arrays, pointers, structures, and file handling.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | **Apply** the basics of software, hardware, number systems, and programming concepts to write simple C programs. **(BL3)** |
| 2 | **Implement** decision-making and control structures like if-else, switch, loops, and unconditional statements in C programs. **(BL3)** |
| 3 | **Analyze** and **manipulate** arrays and strings, and **design** modular programs using functions and recursion. **(BL4)** |
| 4 | **Utilize** pointers for dynamic memory allocation, pointer arithmetic, and complex data structure manipulation in C programs. **(BL3)** |
| 5 | **Construct** and **manage** complex data structures like structures and unions, and **develop** file handling operations in C. **(BL6)** |
| 6 | **Design** and **develop** comprehensive C programs by integrating various programming concepts to solve complex problems using procedural programming techniques. **(BL6)** |

**SYLLABUS**

| **Unit I** | **INTRODUCTION TO PROGRAMMING** | **8 hr** |
|---|---|---|

Software, hardware, Number Systems (Binary, Hexadecimal, Octal, Decimal); Algorithms, pseudo code; Flowcharts, Program development steps; Structure of c program with example;

Tokens, Basic data types; Operators Arithmetic, logical, relational, bitwise; ternary, increment /decrement, special operators, assignment; Built-in Input/output Functions, Expressions, type casting.

| **Unit II** | **SELECTION AND CONTROL STATEMENTS** | **8 hr** |
|---|---|---|

Two way selection statements if, if-else with examples; Nested if with examples; Multiway selection statements - switch with examples; Nested switch with examples, else if ladders with examples;

Iterative statements while, do-while with examples; for loop with examples; Nested loops with examples; Un conditional statements; break, continue, goto with examples

| **Unit III** | **INTRODUCTION TO ARRAYS AND STRINGS, MODULAR PROGRAMMING THROUGH FUNCTIONS** | **8 hr** |
|---|---|---|

Array Definition, Declaration and accessing of 1D array; Declaration and accessing of integer 2D array; 2D array applications: matrix addition, multiplication; String definition, declaration and accessing of strings with examples;

Function Definition, prototype, declaration and accessing with examples; Parameter passing mechanisms with examples, Scope and Extent of Variables; Storage classes auto, static, Register and extern with examples; Definition of recursion, types of recursion (direct and indirect) Solving problems using recursive approach like finding factorial, Fibonacci series, Towers of Hanoi.

| **Unit IV** | **POINTERS AND DYNAMIC MEMORY ALLOCATION** | **8 hr** |
|---|---|---|

Definition of pointers, declaration, initialization, Pointer arithmetic; Representing 1D array using pointers with examples; Representing 2D arrays using pointers

| | | |
|---|---|---|
| with examples; Pointer to pointer, constant pointers with examples, Pointer to constant variable, void pointer, generic pointer with examples;<br>Pointers to Functions; Difference between static and dynamic memory allocation, Dynamic memory allocation using built-in functions (malloc (), calloc ()) ; Dynamic memory allocation using built-in functions (realloc (), free ()) ; Dangling pointer and unreferenced memory problem | | |
| **Unit V** | **STRUCTURES, UNIONS AND FILE HANDLING** | **8 hr** |
| Structure definition, declaration, initialization and accessing structure members; Nested structures with examples, arrays of structures; Pointer to structures with examples, Self-Referential structures; Unions, Bitfields, typedef with examples;<br>Concept of a file and file modes, Formatted I/O; File handling functions; fopen (), fclose (), fscanf (), fprintf (); Random access files handling functions, command line arguments ; Text files, Binary files, Differences between text and Binary files, fread (), fwrite () | | |
| LEARNING RESOURCES | | |
| **TEXTBOOKS:** | | |
| 1 | Brian W Kernighan and Dennis M Ritchie, *The C programming Language*, Second Edition, Pearson, 2015. | |
| 2 | Pradip Dey, Manas Ghosh, *Programming In C*, 2nd Edition, Oxford Higher Education, 2011. | |
| **REFERENCE BOOKS:** | | |
| 1 | Dr Reema Thareja, *Programming in C*, Third Edition, Oxford Press, 2023. | |
| 2 | Byron Gottfried, *Programming with C*, Third Edition. Schaums Outlines Series, 2017. | |
| 3 | Ajay Mittal, *Programming in C - A Practical Approach*, Pearson, 2010. | |
| **ONLINE COURSES** | | |
| 1 | https://mvgrce.codetantra.com | |
| 2 | www.netacad.com | |

**BLOOM'S LEVEL - UNITS CATCHMENT ARTICULATION MATRIX**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| **CO1** | BL3 | X | | | | |
| **CO2** | BL3 | | X | | | |
| **CO3** | BL4 | | | X | | |
| **CO4** | BL3 | | | | X | |
| **CO5** | BL6 | | | | | X |
| **CO6** | BL6 | X | X | X | X | X |

| R26MENGT002 | WRITTEN COMMUNICATION SKILLS | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28 (L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | ….. | **2** | **0** | **0** | **2** |

**Course Objective**

The course provides an enabling space for the students to translate their structured thoughts into a written form based on context and develop the skill of persuasive communication.

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Demonstrate the ability to comprehend a technical text by identifying the different rhetorical strategies. (**BL-3)** |
| 2 | Apply the mechanics of writing to draft a text in a refined manner. **(BL-3)** |
| 3 | Demonstrate understanding of the techniques involved in answering the questions that test verbal ability. (**BL-3)** |
| 4 | Apply the skill of persuasive communication in drafting professional documents. (**BL-3)** |
| 5 | Demonstrate competence in drafting a Statement of Purpose. **(BL-3)** |

**SYLLABUS**

| **Unit I** | **CRITICAL READING & WRITING** | **5 hrs** |
|---|---|---|

The art of comprehending and interpretating a technical text/article and writing with clarity.
Idea Hierarchy Recognition; Argument Analysis; Evidence Tracking; Rhetorical Strategies; Clarity in Writing Response.

| **Unit II** | **MECHANICS OF WRITING** | **5 hrs** |
|---|---|---|

Action Verb Precision; Logical Sequencing of Ideas; Effective Transitions; Sentence Variety; Paragraph Cohesion

| **Unit III** | **SENTENCE CONSTRUCTION AND ERROR ANALYSIS** | **5 hrs** |
|---|---|---|

Sentence Completion strategies; Error Detection Techniques; Sentence Correction Strategies; Clarity & Precision in Writing; Contextual appropriateness

| **Unit IV** | **PROFESSIONAL WRITING -1** | **5 hrs** |
|---|---|---|

Descriptive writing; Professional e-mail writing; persuasive essay writing; Resume writing; Report writing.

| **Unit V** | **PROFESSIONAL WRITING -2** | **5 hrs** |
|---|---|---|

Narrative writing; Drafting a good Statement of purpose (SoP): Clarity of purpose, evidence -based presentation; constructive presentation

***LEARNING RESOURCES***


| | |
|---|---|
| 1 | Purdue Online Writing Lab (OWL). Purdue University, owl.purdue.edu. |
| 2. | McLean, Scott. Writing for Success. University of Minnesota Libraries Publishing, 2012. |


**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL3 | X | | | | |
| CO2 | BL3 | | X | | | |
| CO3 | BL3 | | | X | | |
| CO4 | BL3 | | | | X | |
| CO5 | BL3 | | | | | X |

| R26MENGT003 | CONSTITUTIONAL VALUES | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28(L) | **L** | **T** | **P** | **C** |
| | Pre-requisite | …. | **2** | **0** | **0** | **2** |

**Course Objective**

The course aims at creating awareness regarding different provisions enshrined in the Constitution and makes students understand the concept of Fundamental Rights.

**Course Outcomes**

| | |
|---|---|
| 1 | Demonstrate understanding of the principles of the Constitution of India. **(BL 3)** |
| 2 | Demonstrate understanding of Constitutional values. **(BL 3)** |
| 3 | Demonstrate understanding of Fundamental Rights and their relevance. **(BL 3)** |
| 4 | Demonstrate understanding of the role of Judiciary in the interpretation and protection of Fundamental Rights. **(BL 3)** |
| 5 | Demonstrate understanding of the role of institutions like National Human Rights Commission in the protection of Fundamental Rights. **(BL 3)** |

**SYLLABUS**

| | | |
|---|---|---|
| **Unit I** | Constitution & Democracy; Understanding the spirit of Indian Constitution; Constitutional Values – social, economic and political Justice; Liberty in thought, expression, belief, faith and worship, equality before law, Fraternity. | **5 hrs** |
| **Unit II** | Interpretation of Articles 14 -31: Right to equality (Articles 14 - 18); Right to freedom (Articles 19-22); Right against exploitation (Articles 23-24). | **5 hrs** |
| **Unit III** | Right to freedom of Religion (Articles 25-28); Cultural and educational Rights (Articles 29-30); | **5 hrs** |
| **Unit IV** | Right to Life and personal liberty (Article 21); Right to constitutional remedies (Article 32) | **5 hrs** |
| **Unit V** | Role of Judiciary and other institutions in the protection of Fundamental Rights; Case Studies. | **5 hrs** |

ARNING RESOURCES

**REFERENCE BOOK:**


| | |
|---|---|
| 1 | Durga Das Basu, et al., *Introduction to the Constitution of India*, Lexis Nexis, 2022. |


**Bloom's level - Units catchment articulation matrix**

| CO | Blooms Level | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| CO1 | BL3 | X | | | | |
| CO2 | BL3 | | X | X | X | X |
| CO3 | BL3 | | X | X | X | X |
| CO4 | BL3 | | X | X | X | X |
| CO5 | BL3 | | | | | X |

| R26MPHYL001 | PHYSICS LAB | | | | | |
|---|---|---|---|---|---|---|
| | **TOTAL CONTACT HOURS** | 28(L) | **L** | **T** | **P** | **C** |
| | **PREREQUISITE** | Higher Secondary School Physics | **0** | **0** | **2** | **1** |

**COURSE OBJECTIVES:**

- Complement classroom learning with laboratory experiments.
- Calibration of instruments like travelling-microscope, spectrometer, cathode-ray-oscilloscope, magnetometer, etc. and to make precise measurements.
- Comprehend the physical principles involved in the conduct of experiments and measure the relevant experimental variables.
- Apply analytical techniques and graphical analysis to experimental data and deduce logical conclusions.

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Identify the crystallographic phase of the sample from X-Ray Diffraction patterns. |
| **CO2** | Determine the transient characteristics of C-R circuits for timers, quantify the critical dielectric parameter, and identify the signature change of the magnetic field caused by the coil carrying current. |
| **CO3** | Investigate the interference patterns of thin films; ascertain the applicability of diffraction grating as a monochromator for isolating a narrow band of wavelength from a from a larger light spectrum. |
| **CO4** | Measure the wavelength of coherent light using a grating, then use the same light to gauge the light gathering capacity of fiber; and to comprehend the practicality of semiconductor diodes. |
| **CO5** | Quantify the elastic modulus of the material; and demonstrate the standing wave patterns on stretched strings. |

**LIST OF EXPERIMENTS:**

| | |
|---|---|
| 1 | Determination of the lattice constant and crystallographic phase of the unknown by using XRD patterns. |
| 2 | Signature variation of magnetic field along the axis of a current carrying circular coil. |
| 3 | Determination of the time constant of R-C circuit. |
| 4 | Determination of the dielectric constant of solid dielectric. |
| 5 | Determination of the radius of curvature of a plano-convex lens by forming Newton's rings. |
| 6 | Determination of the thickness of a fine object by forming an air wedge between two plane glass plates. |
| 7 | Determination of the wavelength of spectral lines by using a transmission grating in normal incidence configuration. |
| 8 | Determination of the wavelength of Laser by using the principle of diffraction. |
| 9 | Determination of the numerical aperture and acceptance angle of the optic fiber. |
| 10 | Determination of the band energy gap of a semiconductor p-n junction diode. |
| 11 | Plot the I/V characteristics of Zener under forward and reverse conditions. |
| 12 | Determination of the rigidity modulus of wire material. |
| 13 | Determination of the frequency of an electric vibrator. |

*** A minimum of ten experiments should be done and certified; out of which three experiments, if required, can be performed in virtual mode.**

| ARNING RESOURCES: | |
|---|---|
| **TEXT BOOK:** | |
| 1 | C.S. Robinson and Dr. Ruby Das, *A Textbook of Engineering Physics Practical*, First edition. Laxmi Publications Pvt. Ltd., 2016. |
| **REFERENCE BOOK:** | |
| 1 | Balasubramanian and M.N. Srinivasan, *A Textbook of Practical Physics*, First edition, S. Chand Publishers, 2017. |
| **ADDITION REFERNCE MATERIAL:** | |
| 1 | https://www.vlab.co.in/broad-area-physical-sciences |

CO MAPPING TO EXPERIMENTS:

| CO | BL | EXPERIMENT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| CO1 | BL-3 | X | | | | | | | | | | | | |
| CO2 | BL-3 | | X | X | X | | | | | | | | | |
| CO3 | BL-3 | | | | | X | X | X | X | | | | | |
| CO4 | BL-3 | | | | | | | | | X | X | X | | |
| CO5 | BL-3 | | | | | | | | | | | | X | X |

| R26MSCSL002 | PROCEDURAL PROGRAMMING LABORATORY | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 28 (P) | **L** | **T** | **P** | **C** |
| | Pre-requisite | - | **0** | **0** | **2** | **1** |

**Course Objective**

To get practical exposure to the Structured Programming with hands-on experience in laboratory for solving real world problems using C

**Course Outcomes**

After completing this course, the students will be able to

| | |
|---|---|
| 1 | Students will write and execute simple C programs, demonstrating understanding of basic input/output operations and program structure. |
| 2 | Students will use various operators and control structures to perform decision-making and repetitive tasks. |
| 3 | Students will declare, initialize, and perform operations on one-dimensional and multi-dimensional arrays, as well as handle string operations. |
| 4 | Students will define, call, and pass parameters to functions, including recursive functions, to solve problems in a modular and efficient manner. |
| 5 | Students will use pointers for dynamic memory allocation, manipulate structures and unions, and perform file operations for reading and writing data in text and binary formats. |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Week-1: Introduction to Programming with operators<br>**1.** Write a C program to print "Hello, World!" and understand the structure of a basic C program.<br>**2.** Write a C program to demonstrate the use of basic I/O statements (printf, scanf)<br>**3.** Write a C program for calculating the sum of two numbers. |
| 2 | Week-2: Expressions and Operators<br>1. Write a C program to finding the maximum of three numbers using conditional operator.<br>**2.** Write a C Program to convert temperature from Celsius to Fahrenheat and vice versa<br>**3.** Write a C Program to to calculate simple and compound interest |
| 3 | Week 3: Selection Statements<br>**1.** Write a C program to find the largest of three numbers using if-else statements.<br>**2.** Write a program to demonstrate the use of switch-case statements to perform arithmetic operations based on user choice.<br>**3.** Write a program to demonstrate the use of else-if ladder to grade student marks. |
| 4 | Week-4: Loops<br>**1.** Write a C program to print sum of the digits of the given number.<br>**2.** Write a C program to print the Fibonacci series up to n terms using a for loop.<br>**3.** Write a C program to check the given number is a palindrome or not.<br>**4.** Write a C program to calculate the factorial of a number using a while loop. |

| | |
|---|---|
| 5 | Week-5: Nested Loops and branching<br>**1.** Write a C program to print a pyramid patterns using nested loops.<br>**2.** Write a C program to print prime numbers between 1 to 100<br>**3.** Write a C program to demonstrate the use of break and continue statements within loops. |
| 6 | Week 6: Arrays<br>**1.** Write a C program to find the sum of all elements in a 1D array.<br>**2.** Write a C program to read and print the 2D Array elements in a matrix form.<br>**3.** Write a C program to perform matrix addition using 2D arrays.<br>**4.** Write a C program to find the transpose of a given matrix. |
| 7 | Week-7: String Handling<br>**1.** Write a program to demonstrate string operations (copy, concatenate, compare, length) using built-in functions.<br>**2.** Write a C program to count the number of vowels in a string.<br>**3.** Write a C program to concatenate two strings without using the library function strcat. |
| 8 | Week-8: Functions<br>**1.** Write a program to define and use a function to find the sum of two numbers.<br>**2.** Write a C program to check the given number is prime or not using a function.<br>**3.** Demonstrate passing of an array to a C function. |
| 9 | Week-9: Recursive Functions<br>**1.** Write a recursive program to generate Fibonacci series.<br>**2.** Write a C program to find the GCD of two numbers using a recursive function.<br>**3.** Write a C Program to find the nCr value for the two positive numbers where n > r using recursion. |
| 10 | Week-10: Pointers & Dynamic Memory Allocation<br>**1.** Write a program to demonstrate pointer arithmetic.<br>**2.** Write a program to use pointers to access elements of an array.<br>**3.** Write a program to dynamically allocate memory for an array using malloc and calloc.<br>**4.** Write a program to demonstrate the use of realloc and free for dynamic memory allocation. |
| 11 | Week-11: Structures & Unions<br>**1.** Write a program to define, declare, and access members of a structure.<br>**2.** Write a program to demonstrate the use of nested structures.<br>**3.** Write a C program to store and display student information using structures. |
| 12 | Week-12: File Handling<br>**1.** Write a program to demonstrate file handling functions (fopen, fclose, fscanf, fprintf).<br>**2.** Write a program to read and write data to a binary file using fread and fwrite.<br>**3.** Write a C program to simulate copy command using command line arguments. |

| LEARNING RESOURCES | |
|---|---|
| **TEXTBOOKS:** | |
| 1 | Brian W Kernighan and Dennis M Ritchie, *The C programming Language*, Prentice Hall. |
| 2 | Pradip Dey, Manas Ghosh, *Programming In C*, Oxford Higher Education. |
| **REFERENCE BOOKS:** | |
| 1 | Dr Reema Thareja, *Programming in C*, Third Edition, Oxford Press |
| 2 | Byron Gottfried, *Programming with C*, Schaums Outlines Series, Third Edition. |
| 3 | Ajay Mittal, *Programming in C - A Practical Approach*, Pearson |
| **ONLINE COURSES** | |
| 1 | https://www.tutorialspoint.com/learn_c_by_examples |

| R26MMECD001 | COMPUTER AIDED ENGINEERING DRAWING | | | | | |
|---|---|---|---|---|---|---|
| | Total Contact Hours | 14(T)+28(P) | **L** | **T** | **P** | **C** |
| | Pre-requisite | Nil | **1** | **0** | **2** | **2** |

**Course Objective:** To enable the students to learn various concepts of engineering graphics using the CAD tool.

**Course Outcomes**

| | |
|---|---|
| 1 | Sketch the two-dimensional drawings using draw, modify, and annotation commands in CAD software |
| 2 | Draw the projections and solve the problems in projections of points, lines, planes & solids. |
| 3 | Create orthographic projections and isometric projections and create composite solids using CAD software. |

**SYLLABUS:**

**Module 1:**

**Overview of CAD Software:**

Computer technologies that impact graphical communication, Demonstrating knowledge of CAD software such as The Menu System, Toolbars, Command window, and Status Bar.

Set up the drawing page and the printer, Scale settings, setting up of units and drawing limits, standards for annotations, and 3D Modelling.

**Module 2:**

**Introduction to Orthographic Projections**: Projections of points, straight lines, planes and simple solids

**Module 3:**

Development of surfaces of simple solids, isometric views, Conversion of isometric views to orthographic views. And create complex compound solids in CAD

**List of Exercises**

| | |
|---|---|
| 1 | Creation of simple 2-D geometries |
| 2 | Creation of complex 2-D geometries & Engineering Curves –Generic method for Conic sections |
| 3 | Engineering Curves – Cycloids & Involutes |
| 4 | Orthographic Projection of Points |
| 5 | Projection of lines in simple positions and inclined to one plane |
| 6 | Projection of lines inclined to both planes |
| 7 | Projection of planes is simple and inclined to one plane |
| 8 | Projection of planes inclined to both planes |
| 9 | Projection of solids simple positions |
| 10 | Development of simple Solids (Prisms, Pyramids, Cylinder & Cone) |
| 11 | Conversion of orthographic views to isometric views |
| 12 | Modeling of complex 3D geometries and their conversion to orthographic views |

**LEARNING RESOURCES**

**TEXT BOOKS:**


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

| REFERENCE BOOKS: | |
|---|---|
| 1 | K.L. Narayana and P. Kannaiah, *Engineering Drawing*, Tata McGraw Hill, Third Edition, 2013. |
| 2 | M.B.Shah and B.C. Rana, *Engineering Drawing*, Pearson Education Inc., 2009. |
| **ADDITIONAL REFERENCE MATERIAL** | |
| 1 | https://nitc.ac.in/imgserver/uploads/attachments/Ed__5c3343c5-c3f9-468a-b114-8f33556810b4_.pdf |