# SYLLABUS

## FOR

## I and II Semester B.E.

(Common to All Branches of Engineering)

**2026-2027**

**Siddaganga Institute of Technology**

An Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi,
Approved by AICTE, New Delhi, Accredited by NAAC with A++ Grade
and ISO 9001:2015 Certified

Tumakuru - 572103, Karnataka, India. Web. : www.sit.ac.in

# SYLLABUS

## FOR

# I and II semester B.E.

## (All Engineering Streams)

# 2026 - 2027


**Sree Siddaganga Education Society®**

## Siddaganga Institute of Technology

**(An Autonomous Institution affiliated to V.T.U., Belagavi, Approved by AICTE, New Delhi, Accredited by NAAC with 'A++' Grade and ISO 9001:2015 Certified)**

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# CONTENTS


| Sl. No. | Particulars | Page No. |
|---|---|---|
| 1 | Applied Mathematics-I for CV stream | 25 |
| 2 | Applied Mathematics-I for CSE stream | 28 |
| 3 | Applied Mathematics-I for ME stream | 31 |
| 4 | Applied Mathematics-I for EEE stream | 34 |
| 5 | Applied Mathematics-II for CV stream | 37 |
| 6 | Applied Mathematics-II for CSE stream | 40 |
| 7 | Applied Mathematics-II for ME stream | 43 |
| 8 | Applied Mathematics-II for EEE stream | 46 |
| 9 | Physics for Sustainable Structural System (CV stream) | 49 |
| 10 | Quantum Physics and Applications (CSE stream) | 54 |
| 11 | Physics of Materials (Mech. stream) | 58 |
| 12 | Electrical Engineering Materials (EEE) | 63 |
| 13 | Quantum Physics and Electronics Sensors (ECE stream) | 68 |
| 14 | Applied Chemistry for Sustainable Structures and Material Design (CV) | 72 |
| 15 | Applied Chemistry for Smart Systems (CSE) | 78 |
| 16 | Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems (ME) | 84 |
| 17 | Applied Chemistry for Emerging Electronics and Futuristic Devices (EEE & ECE stream) | 90 |
| 18 | Building Materials | 96 |
| 19 | Elements of Mechanical Engineering | 99 |
| 20 | Basics of Electrical Engineering | 102 |
| 21 | Fundamentals of Electronics & Communication Engineering | 105 |
| 22 | Structured Programming in C | 108 |

| | | |
|---|---|---|
| 23 | Elements of Biotechnology and Biomimetics | 111 |
| 24 | Building Materials Lab | 114 |
| 25 | Elements of Mechanical Engineering Lab | 116 |
| 26 | Basic Electrical Laboratory | 118 |
| 27 | Fundamentals of Electronics & Communication Engineering Lab | 121 |
| 28 | C Programming Lab | 123 |
| 29 | Elements of Biotechnology Laboratory | 127 |
| 30 | Introduction to Electrical Engineering | 129 |
| 31 | Introduction to Electronics & Communication Engineering | 132 |
| 32 | Introduction to Mechanical Engineering | 135 |
| 33 | Essentials of Information Technology | 138 |
| 34 | Introduction to Building Sciences | 141 |
| 35 | Applied Mechanics | 144 |
| 36 | Introduction to C Programming (for Non – IT programmes) | 147 |
| 37 | Python Programming (For CSE and allied programmes) | 150 |
| 38 | Introduction to AI and Applications | 155 |
| 39 | Balake Kannada | 159 |
| 40 | Samkruthika Kannada | 162 |
| 41 | Communication Skills | 164 |
| 42 | Soft Skills | 169 |
| 43 | Indian Constitution and Engineering Ethics | 174 |
| 44 | Computer Aided Engineering Drawing for CV Stream | 176 |
| 45 | Computer Aided Engineering Drawing for CSE Stream | 180 |
| 46 | Computer Aided Engineering Drawing for ME Stream | 183 |
| 47 | Computer Aided Engineering Drawing for EEE Stream | 186 |
| 48 | Computer Aided Engineering Drawing for ECE Stream | 189 |

| | | |
|---|---|---|
| 49 | Innovation and Design Thinking Lab (**Project-based learning - IDEA Lab Workshop/Maker's space**) | 192 |
| 50 | Interdisciplinary Project-Based Learning | 196 |
| | **GENERAL INFORMATION** | |
| 51 | Students Induction Program (SIP) | 197 |
| 52 | AICTE Activity Points | 198 |
| 53 | Program Outcomes | 200 |


| **Code** | | **Programs** |
|---|---|---|
| CV | : | Civil Engineering |
| ME | : | Mechanical Engineering |
| EE | : | Electrical & Electronics Engineering |
| EC | : | Electronics & Communication Engineering |
| CH | : | Chemical Engineering |
| EI | : | Electronics and Instrumentation Engineering |
| IM | : | Industrial Engineering & Management |
| CS | : | Computer Science & Engineering |
| IS | : | Information Science & Engineering |
| BT | : | Biotechnology |
| CI | : | Computer Science & Engineering<br>(Artificial Intelligence and Machine Learning) |


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# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

**I Semester (Physics Cycle)** **Civil Engineering Stream (CV)**

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMC1 | Applied Mathematics-I (CV Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 2. | ASC(IC) | APC | Physics for Sustainable Structural System | Phy | 42 | 0 | 28 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 3. | PSC | PSC8 | Building Materials | CV | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 4. | ESC-I | ESCO6 | Introduction to Electrical Engineering | EE | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 5. | ETC | ETC13 | Introduction to AI and Applications | CS & Allied Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 6. | AEC | CC09 | Soft Skills | Humanities (T&P) | 15 | 0 | 0 | 0 | 15 | 01 | 100 | --- | 100 | PP |
| 7. | PSCL | PSCL1 | Building Materials Lab | CV | 0 | 0 | 28 | 2 | 30 | 02 | 50 | 50 | 100 | 01 |
| 8. | AEC/SDC | SDCCV1 | Innovation and Design Thinking Lab (**Project-based learning**- IDEA Lab Workshop/Maker's space) | Respective /Any Dept. | 0 | 0 | 28 | 2 | 30 | 02 | 50 | 50 | 100 | 01 |
| 9. | HSMS | CC04/ CC03 | Samskruthika Kannada / Balake Kannada | Humanities | 15 | 0 | 0 | 15 | 30 | 01 | 50 | 50 | 100 | 01 |
| | | | **Total** | | | | | | | | **500** | **400** | **900** | **20** |
| 10. | **AICTE Activity Points** (Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | Compulsory requirement for the award of a degree | | | | | | | | | | |

**TW&SL-**Team Works and Self Learning, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE**–Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non credit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

| **Credit Definition:** | |
|---|---|
| 1-hour Lecture **(L)** per week=**1Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session |
| 2-hours Tutorial**(T)** per week=**1Credit** | 04-Credits (IC) are to be designed for 40 hours' theory and 10-12 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session |
| 3-2-hours Practical / Drawing **(P)** per week=**1Credit** | 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session |
| | 01-Credit courses are to be designed for 12 hours of Teaching-Learning sessions |

**AMC1 and APC are integrated courses (IC), combining theory with practical components.**

The theory sessions conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

The **Student Induction Programme** (SIP), initiated by the All-India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. The first year of Engineering programmes is composed of I semester and II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules, Lectures by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions. The specific programmes to be conducted will be notified separately by the University, with the academic calendar or separately.

**AICTE Activity Points Requirement for BE/B.Tech. Programmes**

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be earned is to be eligible for the award of their degree.

- **Regular students** admitted to a 4-year degree program must earn **100 Activity Points.**
- **Lateral entry students** (joining from the second year) must earn **75 Activity Points.**
- **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**.

The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

| Code | Program Specific Course (PSC) | L | T | P | Cr | Code | Program Specific Course Lab (PSCL) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PSC1 | Building Materials and Concrete Technology | 3 | 0 | 0 | 3 | PSCL1 | Building Materials Lab | 0 | 0 | 2 | 1 |
| PSC2 | Elements of Mechanical Engineering | 3 | 0 | 0 | 3 | PSCL2 | Elements of Mechanical Engineering Lab | 0 | 0 | 2 | 1 |
| PSC3 | Basics of Electrical Engineering | 3 | 0 | 0 | 3 | PSCL3 | Basic Electrical Laboratory | 0 | 0 | 2 | 1 |
| PSC4 | Fundamentals of ECE | 3 | 0 | 0 | 3 | PSCL4 | Fundamentals of Electronics & Communication Engg. Lab | 0 | 0 | 2 | 1 |
| PSC5 | Structured Programming in C | 3 | 0 | 0 | 3 | PSCL5 | C Programming Lab | 0 | 0 | 2 | 1 |
| PSC6 | Elements of Biotechnology and Biomimetics | 3 | 0 | 0 | 3 | PSCL6 | Elements of Biotechnology Laboratory | 0 | 0 | 2 | 1 |
| PSC7 | Principles of Soil Science and Agronomy | 3 | 0 | 0 | 3 | PSCL7 | Soil Science and Agronomy Field Lab | 0 | 0 | 2 | 1 |
| PSC8 | Building Materials | 3 | 0 | 0 | 3 | | | | | | |
| | **Engineering Science Courses-I (ESC-I)** | | | | | | | | | | |
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO7 | Introduction to Electronics & Communication Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | |
| ESCO11 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | |

**The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-I** and **Applied Physics courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Programme Specific Courses (PSC):** Programme Specific Courses (PSC) are a set of core courses tailored to the specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in their chosen field. Students must select and complete the courses from this group that **correspond to their admitted program stream**. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL)** group.

**Engineering Sciences Courses-I (ESC-I):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

**II Semester (Chemistry Cycle)** **Civil Engineering Stream (CV)**

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMC2 | Applied Mathematics-II (CV Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 2. | ASC(IC) | ACC | Applied Chemistry for Sustainable Structures and Material Design | Che | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 3. | ESC | CAEDC | Computer-Aided Engineering Drawing for CV Stream | ME | 30 | 0 | 28 | 32 | 90 | 3 | 50 | 50 | 100 | **03** |
| 4. | ESC-II | ESC011 | Applied Mechanics | CV | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | **03** |
| 5. | PLC(IC) | PLC5 | Introduction to C Programming | CS & Allied Dept. | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 6. | AEC | CC08 | Communication Skills | Humanities (T&P) | 15 | 0 | 0 | 15 | 30 | 2 | 50 | 50 | 100 | **01** |
| 7. | NCMC | CC10 | Indian Constitution and Engineering Ethics | Humanities | 15 | 0 | 0 | 0 | 15 | 1 | 100 | 0 | 100 | **PP** |
| 8. | AEC/SDC | SDC2 | Interdisciplinary Project-Based Learning | Res. Dept. (Multiple Dept.) | 0 | 0 | 0 | 30 | 30 | 2 | 50 | 50 | 100 | **01** |
| | | | **Total** | | | | | | | | **450** | **350** | **800** | **20** |
| 9. | **AICTE Activity Points** (Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | Compulsory requirement for the award of a degree | | | | | | | | | | |

**TW&SL-**Team Works and Self Learning, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC-** Ability Enhancement Course, **AEC/SDC-** Ability Enhancement Course/Skill Development course, **ETC-** Emerging Technology Course, **TD/PSB-** Teaching Department / Paper Setting Board, **HSMC-**Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE-** Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a noncredit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

**ACC and PLC are integrated courses (IC), combining theory with practical components.**

The theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

| Code | Engineering Sciences Courses - II (ESC-II) | L | T | P | Cr | | | Programming Language Courses (PLC) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | PLC5 | Introduction to C Programming (for Non- IT programmes) | 3 | 0 | 2 | 4 |
| ESCO7 | Introduction to Electronics & Communication Engineering | 3 | 0 | 0 | 3 | | PLC6 | Python Programming (For CSE and allied programmes) | 3 | 0 | 2 | 4 |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO11 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | | |

**The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-II** and **Applied Chemistry courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Engineering Sciences Courses-II (ESC-II):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

For the course ***Interdisciplinary Project***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.

**Computer-Aided Engineering Drawing:** The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

## I Semester (Physics Cycle) — Computer Science and Engineering Stream (CS, CI, IS, BT)

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMS1 | Applied Mathematics-I (CSE Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 2. | ASC(IC) | APS | Quantum Physics and Applications | Phy | 42 | 0 | 28 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 3. | PSC | PSC5<br>PSC6 | **CS, CI, IS** - Structured Programming in C<br>**BT** - Elements of Biotechnology and Biomimetics | CS/IS/BT | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 4. | ESC | ESC06<br>ESC07<br>ESC09 | **CS** - Introduction to Electrical Engg.<br>**CI, IS** - Introduction to Electronics & Communication Engg.<br>**BT** - Essentials of Information Technology | EEE/ME Stream Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 5. | ETC | ETC13 | Introduction to AI and Applications | CS & Allied Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 6. | AEC | CC09 | Soft Skills | Humanities (T&P) | 15 | 0 | 0 | 0 | 15 | 01 | 100 | --- | 100 | PP |
| 7. | PSCL | PSCL5<br>PSCL6 | **CS, CI, IS** - C Programming Lab<br>**BT** - Elements of Biotechnology Lab | CS/IS/BT | 0 | 0 | 28 | 02 | 30 | 02 | 50 | 50 | 100 | 01 |
| 8. | AEC/SDC | SDCxx1 | Innovation and Design Thinking Lab<br>**(Project-based learning**- IDEA Lab Workshop/Maker's space) | Respective (Any) Dept. | 0 | 0 | 28 | 02 | 30 | 02 | 50 | 50 | 100 | 01 |
| 9. | HSMS | CC04/<br>CC03 | Samskruthika Kannada /<br>Balake Kannada | Humanities | 15 | 0 | 0 | 15 | 30 | 01 | 50 | 50 | 100 | 01 |
| | | | **Total** | | | | | | | | **500** | **400** | **900** | **20** |
| 10. | **AICTE Activity Points**<br>(Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | Compulsory requirement for the award of a degree | | | | | | | | | | |

**TW&SL**-Team Works and Self Learning, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non credit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

| **Credit Definition:** | |
|---|---|
| 1-hour Lecture **(L)** per week=**1Credit**<br>2-hours Tutorial**(T)** per week=**1Credit**<br>3-2-hours Practical / Drawing **(P)** per week=**1Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session<br>04-Credits (IC) are to be designed for 40 hours' theory and 10-12 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session<br>02- Credits courses are to be designed for 25 hours of Teaching-Learning Session<br>01-Credit courses are to be designed for 12 hours of Teaching-Learning sessions |

**AMS1 and APS are integrated courses (IC), combining theory with practical components.**

The theory sessions conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

The **Student Induction Programme** (SIP), initiated by the All-India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. The first year of Engineering programmes is composed of I semester and II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules, Lectures by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions. The specific programmes to be conducted will be notified separately by the University, with the academic calendar or separately.

**AICTE Activity Points Requirement for BE/B.Tech. Programmes**

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be earned is to be eligible for the award of their degree.

- **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
- **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
- **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card.**

The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

| Code | Program Specific Course (PSC) | L | T | P | Cr | Code | Program Specific Course Lab (PSCL) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PSC1 | Building Materials and Concrete Technology | 3 | 0 | 0 | 3 | PSCL1 | Building Materials Lab | 0 | 0 | 2 | 1 |
| PSC2 | Elements of Mechanical Engineering | 3 | 0 | 0 | 3 | PSCL2 | Elements of Mechanical Engineering Lab | 0 | 0 | 2 | 1 |
| PSC3 | Basics of Electrical Engineering | 3 | 0 | 0 | 3 | PSCL3 | Basic Electrical Laboratory | 0 | 0 | 2 | 1 |
| PSC4 | Fundamentals of ECE | 3 | 0 | 0 | 3 | PSCL4 | Fundamentals of Electronics & Communication Engg. Lab | 0 | 0 | 2 | 1 |
| PSC5 | Structured Programming in C | 3 | 0 | 0 | 3 | PSCL5 | C Programming Lab | 0 | 0 | 2 | 1 |
| PSC6 | Elements of Biotechnology and Biomimetics | 3 | 0 | 0 | 3 | PSCL6 | Elements of Biotechnology Laboratory | 0 | 0 | 2 | 1 |
| PSC7 | Principles of Soil Science and Agronomy | 3 | 0 | 0 | 3 | PSCL7 | Soil Science and Agronomy Field Lab | 0 | 0 | 2 | 1 |
| PSC8 | Building Materials | 3 | 0 | 0 | 3 | | | | | | |
| | **Engineering Science Courses-I (ESC-I)** | | | | | | | | | | |
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO7 | Introduction to Electronics & Communication Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | |
| ESCO11 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | |

**The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-I** and **Applied Physics courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Programme Specific Courses (PSC):** Programme Specific Courses (PSC) are a set of core courses tailored to the specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in their chosen field. Students must select and complete the courses from this group that **correspond to their admitted program stream**. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL)** group.

**Engineering Sciences Courses-I (ESC-I):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

## II Semester (Chemistry Cycle) — Computer Science and Engineering Stream (CS, CI, IS, BT)

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMS2 | Applied Mathematics-II (CSE Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 2. | ASC(IC) | ACS | Applied Chemistry for Smart Systems | Che | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 3. | ESC | CAEDS | Computer-Aided Engineering Drawing CSE Stream | ME | 30 | 0 | 28 | 32 | 90 | 3 | 50 | 50 | 100 | **03** |
| 4. | ESC | ESC07<br>ESC06 | **CS, BT-** Introduction to Electronics & Communication Engg.<br>**CI, IS** - Introduction to Electrical Engg. | EEE/ME Stream Dept. | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | **03** |
| 5. | PLC(IC) | PLC6 | Python Programming | CS & Allied Dept. | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 6. | AEC | CC08 | Communication Skills | Humanities (T&P) | 15 | 0 | 0 | 15 | 30 | 2 | 50 | 50 | 100 | **01** |
| 7. | NCMC | CC10 | Indian Constitution and Engineering Ethics | Humanities | 15 | 0 | 0 | 0 | 15 | 1 | 100 | 0 | 100 | **PP** |
| 8. | AEC/SDC | SDC2 | Interdisciplinary Project-Based Learning | Res. Dept. (Multiple Dept.) | 0 | 0 | 0 | 30 | 30 | 2 | 50 | 50 | 100 | **01** |
| | | | **Total** | | | | | | | | **450** | **350** | **800** | **20** |
| 9. | **AICTE Activity Points**<br>(Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | Compulsory requirement for the award of a degree | | | | | | | | | | |

**TW&SL**-Team Works and Self Learning, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a noncredit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

**AMS2, ACS and PLC6 are integrated courses (IC), combining theory with practical components.**

The theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

| Code | Engineering Sciences Courses - II (ESC-II) | L | T | P | Cr | | | Programming Language Courses (PLC) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC06 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | PLC5 | Introduction to C Programming (for Non- IT programmes) | 3 | 0 | 2 | 4 |
| ESC07 | Introduction to Electronics & Communication Engg. | 3 | 0 | 0 | 3 | | PLC6 | Python Programming (For CSE and allied programmes) | 3 | 0 | 2 | 4 |
| ESC08 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESC09 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | | |
| ESC010 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | | |
| ESC011 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | | |

**The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-II** and **Applied Chemistry courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Engineering Sciences Courses-II (ESC-II):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

For the course ***Interdisciplinary Project***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.

**Computer-Aided Engineering Drawing:** The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

**I Semester (Chemistry Cycle)** **Mechanical Engineering Stream (ME, IM, CH)**

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMM1 | Applied Mathematics-I (ME Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 2. | ASC(IC) | ACM | Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems | Che | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 3. | ESC | CAEDM | Computer-Aided Engineering Drawing for ME Stream | ME | 30 | 0 | 28 | 32 | 90 | 3 | 50 | 50 | 100 | **03** |
| 4. | ESC-I | ESC07 | Introduction to Electronics & Communication Engineering | Res.Dept. | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | **03** |
| 5. | PLC(IC) | PLC5 | Introduction to C Programming | CS & Allied Dept. | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 6. | AEC | CC08 | Communication Skills | Humanities (T&P) | 15 | 0 | 0 | 15 | 30 | 2 | 50 | 50 | 100 | **01** |
| 7. | NCMC | CC10 | Indian Constitution and Engineering Ethics | Humanities | 15 | 0 | 0 | 0 | 15 | 1 | 100 | 0 | 100 | **PP** |
| 8. | AEC/SDC | SDCxx1 | Innovation and Design Thinking Lab (**Project-based learning**- IDEA Lab Workshop/Maker's space) | Respective (Any) Dept. | 0 | 0 | 28 | 02 | 30 | 2 | 50 | 50 | 100 | **01** |
| | | | **Total** | | | | | | | | **450** | **350** | **800** | **20** |
| 9. | **AICTE Activity Points** (Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | Compulsory requirement for the award of a degree | | | | | | | | | | |

**TW&SL**-Team Works and Self Learning, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a noncredit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

| **Credit Definition:** | |
|---|---|
| 1-hour Lecture **(L)** per week=**1Credit**<br>2-hours Tutorial**(T)** per week=**1Credit**<br>3-2-hours Practical / Drawing (P) per week=**1Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session<br>04-Credits (IC) are to be designed for 40 hours' theory and 10-12 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session<br>02- Credits courses are to be designed for 25 hours of Teaching-Learning Session<br>01-Credit courses are to be designed for 12 hours of Teaching-Learning sessions |

**ACM and PLC are integrated courses (IC), combining theory with practical components.**

The theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

The **Student Induction Programme** (SIP), initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. The first year of Engineering programmes is composed of I semester and II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules, Lectures by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions. The specific programmes to be conducted will be notified separately by the University, with the academic calendar or separately.

**AICTE Activity Points Requirement for BE/B.Tech. Programmes**

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be earned is to be eligible for the award of their degree.

- **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
- **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
- **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**. The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

| Code | Engineering Sciences Courses - II (ESC-II) | L | T | P | Cr | | | Programming Language Courses (PLC) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC06 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | PLC5 | Introduction to C Programming (for Non- IT programmes) | 3 | 0 | 2 | 4 |
| ESC07 | Introduction to Electronics & Communication Engg. | 3 | 0 | 0 | 3 | | PLC6 | Python Programming (For CSE and allied programmes) | 3 | 0 | 2 | 4 |
| ESC08 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESC09 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | | |
| ESC010 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | | |
| ESC011 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | | |

**The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-II** and **Applied Chemistry courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Engineering Sciences Courses-II (ESC-II): C**ourses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

For the course ***Interdisciplinary Project***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.

**Computer-Aided Engineering Drawing:** The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

**II Semester (Physics Cycle)** **Mechanical Engineering Stream (ME, IM, CH)**

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AMM2 | Applied Mathematics-II (ME Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 2. | ASC(IC) | APM | Physics of Materials | Phy | 42 | 0 | 28 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 3. | PSC | PSC2 | Elements of Mechanical Engg. | Res. Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 4. | ESC-II | ESCO11<br>ESCO9<br>ESCO6 | **ME-** Applied Mechanics<br>**IM-** Essentials of Information Technology<br>**CH-** Introduction to Electrical Engineering | Res. Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 5. | ETC | ETC13 | Introduction to AI and Applications | CS & Allied Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 6. | AEC | CC09 | Soft Skills | Humanities (T&P) | 15 | 0 | 0 | 0 | 15 | 01 | 100 | --- | 100 | PP |
| 7. | PSCL | PSCL2 | Elements of Mechanical Engg. Lab | Res.Dept. | 0 | 0 | 28 | 02 | 30 | 02 | 50 | 50 | 100 | 01 |
| 8. | HSMS | CC04/ CC03 | Samkrutika Kannada / Balake Kannada | Humanities | 15 | 0 | 0 | 15 | 30 | 01 | 50 | 50 | 100 | 01 |
| 9. | AEC/ SDC | SDC2 | Interdisciplinary Project-Based Learning | Res. Dept. (Multiple Dept.) | 0 | 0 | 0 | 30 | 30 | 02 | 50 | 50 | 100 | 01 |
| | | | **Total** | | | | | | | | **500** | **400** | **900** | **20** |
| 10. | **AICTE Activity Points**<br>(Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | | Compulsory requirement for the award of a degree | | | | | | | | | |

**TW&SL**-Team Works and Self Learning, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non credit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

**APM is an integrated course (IC), combining theory with practical components.**

The theory sessions conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

| Code | Program Specific Course (PSC) | L | T | P | Cr | Code | Program Specific Course Lab (PSCL) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PSC1 | Building Materials and Concrete Technology | 3 | 0 | 0 | 3 | PSCL1 | Building Materials Lab | 0 | 0 | 2 | 1 |
| PSC2 | Elements of Mechanical Engineering | 3 | 0 | 0 | 3 | PSCL2 | Elements of Mechanical Engineering Lab | 0 | 0 | 2 | 1 |
| PSC3 | Basics of Electrical Engineering | 3 | 0 | 0 | 3 | PSCL3 | Basic Electrical Laboratory | 0 | 0 | 2 | 1 |
| PSC4 | Fundamentals of ECE | 3 | 0 | 0 | 3 | PSCL4 | Fundamentals of Electronics & Communication Engg. Lab | 0 | 0 | 2 | 1 |
| PSC5 | Structured Programming in C | 3 | 0 | 0 | 3 | PSCL5 | C Programming Lab | 0 | 0 | 2 | 1 |
| PSC6 | Elements of Biotechnology and Biomimetics | 3 | 0 | 0 | 3 | PSCL6 | Elements of Biotechnology Laboratory | 0 | 0 | 2 | 1 |
| PSC7 | Principles of Soil Science and Agronomy | 3 | 0 | 0 | 3 | PSCL7 | Soil Science and Agronomy Field Lab | 0 | 0 | 2 | 1 |
| PSC8 | Building Materials | 3 | 0 | 0 | 3 | | | | | | |
| | **Engineering Science Courses (ESC)** | | | | | | | | | | |
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO7 | Introduction to Electronics & Communication Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | |

**The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-I** and **Applied Physics courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Programme Specific Courses (PSC):** Programme Specific Courses (PSC) are a set of core courses tailored to the specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in their chosen field. Students must select and complete the courses from this group that **correspond to their admitted program stream**. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL)** group.

**Engineering Sciences Courses-I (ESC-I):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

## (EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)

**I Semester (Chemistry Cycle)** **Electrical and Electronics Engineering Stream (EE, EC, EI)**

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AME1 | Applied Mathematics-I (EEE Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 2. | ASC(IC) | ACE | Applied Chemistry for Emerging Electronics and Futuristic Devices | Che | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 3. | ESC | CAEDEE<br>CAEDEC | **EE** Computer-Aided Engineering Drawing for EEE Stream<br>**EC, EI** Computer-Aided Engineering Drawing for ECE Stream | ME | 30 | 0 | 28 | 32 | 90 | 3 | 50 | 50 | 100 | **03** |
| 4. | ESC | ESCO7<br>ESCO6 | **EE** Introduction to Electronics and Communication Engg.<br>**EC, EI** Introduction to Electrical Engg. | Resp. Dept. | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | **03** |
| 5. | PLC(IC) | PLC5 | Introduction to C Programming | CS & Allied Dept. | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | **04** |
| 6. | AEC | CC08 | Communication Skills | Humanities (T&P) | 15 | 0 | 0 | 15 | 30 | 2 | 50 | 50 | 100 | **01** |
| 7. | NCMC | CC10 | Indian Constitution and Engineering Ethics | Humanities | 15 | 0 | 0 | 0 | 15 | 1 | 100 | 0 | 100 | **PP** |
| 8. | AEC/ SDC | SDCxx1 | Innovation and Design Thinking Lab (**Project-based learning-** IDEA Lab Workshop/Maker's space) | Respective (Any) Dept. | 0 | 0 | 28 | 02 | 30 | 2 | 50 | 50 | 100 | **01** |
| | | | **Total** | | | | | | | | **450** | **350** | **800** | **20** |
| 9. | **AICTE Activity Points** (Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | | Compulsory requirement for the award of a degree | | | | | | | | | |

**TW&SL-**Team Works and Self Learning, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)-** Programming Language Course (Integrated Course), **AEC-** Ability Enhancement Course, **AEC/SDC-** Ability Enhancement Course/Skill Development course, **ETC-** Emerging Technology Course, **TD/PSB-** Teaching Department / Paper Setting Board, **HSMC-**Humanity, Social Science and management Course, **CIE** –Continuous Internal Evaluation, **SEE-** Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a noncredit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

| **Credit Definition:** | |
|---|---|
| 1-hour Lecture **(L)** per week=**1Credit**<br>2-hours Tutorial**(T)** per week=**1Credit**<br>3-2-hours Practical / Drawing **(P)** per week=**1Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session<br>04-Credits (IC) are to be designed for 40 hours' theory and 10-12 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session<br>02- Credits courses are to be designed for 25 hours of Teaching-Learning Session<br>01-Credit courses are to be designed for 12 hours of Teaching-Learning sessions |

**ACE and PLC are integrated courses (IC), combining theory with practical components.**

The theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

The **Student Induction Programme** (SIP), initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. The first year of Engineering programmes is composed of I semester and II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules, Lectures by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions. The specific programmes to be conducted will be notified separately by the University, with the academic calendar or separately.

**AICTE Activity Points Requirement for BE/B.Tech. Programmes**

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be earned is to be eligible for the award of their degree.

- **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
- **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
- **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**. The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

| Code | Engineering Sciences Courses - II (ESC-II) | L | T | P | Cr | | | Programming Language Courses (PLC) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | PLC5 | Introduction to C Programming (for Non- IT programmes) | 3 | 0 | 2 | 4 |
| ESCO7 | Introduction to Electronics & Communication Engg. | 3 | 0 | 0 | 3 | | PLC6 | Python Programming (For CSE and allied programmes) | 3 | 0 | 2 | 4 |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO11 | Applied Mechanics | 3 | 0 | 0 | 3 | | | | | | | |

**The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-II** and **Applied Chemistry courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Engineering Sciences Courses-II (ESC-II):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

For the course ***Interdisciplinary Project***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.

**Computer-Aided Engineering Drawing:** The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

# SCHEME OF TEACHING AND EXAMINATIONS

**(EFFECTIVE FROM THE ACADEMIC YEAR 2025-26)**

## II Semester (Physics Cycle) — Electrical and Electronics Engineering Stream (EE, EC, EI)

| Sl. No. | Course and Course Code | | Course Title | Teaching / Paper setting Dept. | Teaching and Learning scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lecture | Tutorial | Practical/ Drawing | TW&SL | Total Hours / Sem. | Duration in hrs. | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | SL | | | | | | |
| 1. | ASC | AME2 | Applied Mathematics-II (EEE Stream) | Maths | 42 | 28 | 0 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 2. | ASC(IC) | APEE<br>APEC | **EE** Electrical Engineering Materials<br>**EC, EI** Quantum Physics and Electronics Sensors | Phy | 42 | 0 | 28 | 50 | 120 | 03 | 50 | 50 | 100 | 04 |
| 3. | PSC | PSC3<br>PSC4 | **EE** Basics of Electrical Engineering<br>**EC, EI** Fundamentals of ECE | Resp. Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 4. | ESC | ESC09 | Essentials of Information Technology | Resp. Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 5. | ETC | ETC13 | Introduction to AI and Applications | CS & Allied Dept. | 42 | 0 | 0 | 48 | 90 | 03 | 50 | 50 | 100 | 03 |
| 6. | AEC | CC09 | Soft Skills | Humanities (T&P) | 15 | 0 | 0 | 0 | 15 | 01 | 100 | --- | 100 | PP |
| 7. | PSCL | PSCL3<br>PSCL4 | **EE** Basic Electrical Laboratory<br>**EC, EI** Fundamentals of ECE Lab | Resp. Dept. | 0 | 0 | 28 | 02 | 30 | 02 | 50 | 50 | 100 | 01 |
| 8. | HSMS | CC04/<br>CC03 | Samkrutika Kannada /<br>Balake Kannada | Humanities | 15 | 0 | 0 | 15 | 30 | 01 | 50 | 50 | 100 | 01 |
| 9. | AEC/ SDC | SDC2 | Interdisciplinary Project-Based Learning | Resp. Dept. (Multiple Dept.) | 0 | 0 | 0 | 30 | 30 | 02 | 50 | 50 | 100 | 01 |
| | | | **Total** | | | | | | | | **500** | **400** | **900** | **20** |
| 10. | **AICTE Activity Points**<br>(Regular students have to earn 100 activity points from I to VI semesters and Lateral Entry students have to earn 75 activity points from III to VI semesters) | | | | Compulsory requirement for the award of a degree | | | | | | | | | |

**TW&SL-**Team Works and Self Learning, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **PLC(IC)**- Programming Language Course (Integrated Course), **AEC**- Ability Enhancement Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **ETC**- Emerging Technology Course, **TD/PSB**- Teaching Department / Paper Setting Board, **HSMC**-Humanity, Social Science and management Course, **CIE**–Continuous Internal Evaluation, **SEE**- Semester End Examination, **NCMC:** Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non-credit course. "PP" represents pass in course provided students have successfully completed the CIE requirements. Otherwise, "NP-not pass shall be awarded. "PP" is essential for the award of the degree

**APE is an integrated course (IC), combining theory with practical components.**

The theory sessions conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE. However, questions related to the practical content will be included in the SEE question paper as part of the final examination.

| Code | Program Specific Course (PSC) | L | T | P | Cr | | Code | Program Specific Course Lab (PSCL) | L | T | P | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PSC1 | Building Materials and Concrete Technology | 3 | 0 | 0 | 3 | | PSCL1 | Building Materials Lab | 0 | 0 | 2 | 1 |
| PSC2 | Elements of Mechanical Engineering | 3 | 0 | 0 | 3 | | PSCL2 | Elements of Mechanical Engineering Lab | 0 | 0 | 2 | 1 |
| PSC3 | Basics of Electrical Engineering | 3 | 0 | 0 | 3 | | PSCL3 | Basic Electrical Laboratory | 0 | 0 | 2 | 1 |
| PSC4 | Fundamentals of ECE | 3 | 0 | 0 | 3 | | PSCL4 | Fundamentals of Electronics & Communication Engg. Lab | 0 | 0 | 2 | 1 |
| PSC5 | Structured Programming in C | 3 | 0 | 0 | 3 | | PSCL5 | C Programming Lab | 0 | 0 | 2 | 1 |
| PSC6 | Elements of Biotechnology and Biomimetics | 3 | 0 | 0 | 3 | | PSCL6 | Elements of Biotechnology Laboratory | 0 | 0 | 2 | 1 |
| PSC7 | Principles of Soil Science and Agronomy | 3 | 0 | 0 | 3 | | PSCL7 | Soil Science and Agronomy Field Lab | 0 | 0 | 2 | 1 |
| PSC8 | Building Materials | 3 | 0 | 0 | 3 | | | | | | | |
| | **Engineering Science Courses (ESC)** | | | | | | | | | | | |
| ESCO6 | Introduction to Electrical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO7 | Introduction to Electronics & Communication Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO8 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO9 | Essentials of Information Technology | 3 | 0 | 0 | 3 | | | | | | | |
| ESCO10 | Introduction to Building Sciences | 3 | 0 | 0 | 3 | | | | | | | |

**The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.** The **tutorial sessions** for the **mathematics course** shall be conducted in the Laboratory environment using **MATLAB software** to enhance computational understanding and application skills.

Students admitted to a specific engineering stream are required to select and successfully complete **Applied Mathematics-I** and **Applied Physics courses** that are aligned with their program stream. These courses are intended to reinforce the academic foundations and develop the professional competencies relevant to their chosen engineering discipline.

**Programme Specific Courses (PSC):** Programme Specific Courses (PSC) are a set of core courses tailored to the specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in their chosen field. Students must select and complete the courses from this group that **correspond to their admitted program stream**. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL)** group.

**Engineering Sciences Courses-I (ESC-I):** Courses designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete the courses that do not belong to their admitted program stream. For example, a student admitted to the Civil Engineering program must choose a course such as Introduction to Mechanical Engineering or Introduction to Electrical Engineering, rather than Civil Engineering-related subjects. The course selected under Engineering Science Courses – II (ESC-II) must be different from the course chosen under ESC-I and must also not belong to the student's admitted engineering stream.

# Applied Mathematics - I (Civil Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMC1 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of calculus associated with one variable and multivariable arising in engineering.
- **Analyze and solve** engineering problems by applying Ordinary Differential Equations.
- **Demonstrate** the use of analytical and numerical methods to solve the system of linear equations.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### POLAR CURVES AND CURVATURE

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms. **8 Hrs.**

## UNIT - II

### SERIES EXPANSION, INDETERMINATE FORMS AND MULTIVARIABLE CALCULUS

Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial differentiation, total derivative - differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables. **8 Hrs.**

## UNIT - III

### ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors - $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. Orthogonal trajectories**,** Law of natural growth and decay**.** **8 Hrs.**

## UNIT - IV

### ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non-homogeneous equations ($e^{ax}$, $sin(ax+b), cos(ax+b)$, $x^n$ only), Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring. **8 Hrs.**

## UNIT - V

### LINEAR ALGEBRA

Elementary row transformation of a matrix, Rank of a matrix. Echelon form, Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow. **8 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018. |
| 3 | Gilbert Strang | Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | Srimanta Pal & Subodh C.Bhunia, | Engineering Mathematics, Oxford University Press, 3rd Ed., 2016. |
| 3 | N. P. Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014. |
| 5 | David C Lay | Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018. |

## Course Outcomes :

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

**CO1 :** **Apply** the knowledge of calculus to solve problems related to polar curves and implementation using MATLAB.

**CO2 :** **Apply** the concept of partial differentiation to compute rate of change of multivariate functions and implementation using MATLAB.

**CO3 :** **Apply** the analytical methods to solve first order and first-degree differential equations and implementation using MATLAB.

**CO4 :** **Apply** the analytical methods to solve higher order differential equations and implementation using MATLAB.

**CO5 :** **Apply** matrix theory for solving the system of linear equations, compute eigenvalues and eigenvectors and implementation using MATLAB.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics - I
# (Computer Science & Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMS1 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of calculus of scalars and vectors associated with one variable and multivariable arising in engineering.
- **Demonstrate** the use of Linear Algebra to solve the system of equations.
- **Utilize** vector spaces and linear transformations to model and solve problems in Computer Science and Engineering.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### CALCULUS

Partial differentiation, total derivative, differentiation of composite functions, Jacobian, Statement of Taylor's and Maclaurin's series expansion for two variables. Maxima and minima for the function of two variables. **08 Hrs.**

## UNIT – II

### VECTOR CALCULUS

Scalar and vector fields, Gradient, directional derivatives, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.

Introduction to polar coordinates and polar curves.

Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. **08 Hrs.**

## UNIT – III

### SYSTEM OF LINEAR EQUATIONS, EIGEN VALUES & EIGEN VECTORS

Elementary row transformation of a matrix, Echelon form, rank of a matrix. Consistency and solution of system of linear equations: Gauss elimination method, Gauss Jordan method. Applications: Traffic flow.

Eigenvalues and Eigenvectors, diagonalization of the matrix, modal matrix.

**08 Hrs.**

## UNIT – IV

**VECTOR SPACE**

Vector spaces: definition and examples, subspace: definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, row space and column space of a matrix, Coordinates vector, inner products and orthogonality. **08 Hrs.**

## UNIT - V

**LINEAR TRANSFORMATION**

Definition and examples, algebra of linear transformations, matrix of a linear transformation. Singular, non-singular linear transformations and invertible linear transformations. Rank and nullity of linear transformations, Rank-Nullity theorem. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | Gilbert Strang | Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022. |
| 3 | Seymour Lipschutz and Marc Lipson | Linear Algebra, Schaum's outlines series, 4th Ed., 2008. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | N. P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 3 | James Stewart | Calculus, Cengage Publications, 7th Ed., 2019 |
| 4 | David Poole | Linear Algebra, a modern introduction, Cengage publishers, 4th Ed., 2014. |
| 5 | David C Lay | Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018. |
| 6 | Gareth Williams | Linear Algebra with applications, Jones Bartlett Publishers Inc., 6th Ed., 2017. |

## Course Outcomes :

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

**CO1 :** **Apply** the concepts of multivariable calculus in applications of computer science engineering and implementation using MATLAB.

**CO2 :** **Apply** the concept of vector calculus to verify the vector as solenoidal or irrotational. Demonstrate the use of curvilinear coordinates. Implementation using MATLAB.

**CO3 :** **Apply** matrix theory for solving the system of linear equations, compute eigenvalues and eigenvectors and implementation using MATLAB.

**CO4 :** **Identify** the characteristic parameters of the vector spaces.

**CO5 :** **Demonstrate** the use of linear transformation in the computer science and engineering stream.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics – I
# (Mechanical Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMM1 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of calculus associated with one variable and multivariable arising in engineering.
- **Analyze and solve** engineering problems by applying Ordinary Differential Equations.
- **Demonstrate** the use of analytical and numerical methods to solve the system of linear equations.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### POLAR CURVES AND CURVATURE

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms. **08 Hrs.**

## UNIT – II

### SERIES EXPANSION, INDETERMINATE FORMS AND MULTIVARIABLE CALCULUS

Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms-L'Hospital's rule. Partial differentiation, total derivative – differentiation of composite functions. Jacobian. Maxima and minima for the function of two variables. **08 Hrs.**

## UNIT – III

### ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factor: $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$.

Orthogonal trajectories, Law of natural growth and decay. **08 Hrs.**

## UNIT – IV

**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER**

Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non- homogeneous equations($e^{ax}$, sin(ax+b), cos(ax+b), $x^n$only), Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring. **08 Hrs.**

## UNIT - V

**LINEAR ALGEBRA**

Elementary row transformation of a matrix, Echelon form, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018. |
| 3 | Gilbert Strang | Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | Srimanta Pal & Subodh C. Bhunia | Engineering Mathematics, Oxford University Press, 3rd Ed., 2016. |
| 3 | N. P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014. |
| 5 | Ray Wylie, Louis C. Barrett | Advanced Engineering Mathematics, Mc Graw Hill Book Co., New York, 6th Ed., 2017. |

| | | |
|---|---|---|
| 6 | David C Lay | Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018. |
| 7 | Gareth Williams | Linear Algebra with applications, Jones Bartlett Publishers Inc., 6th Ed., 2017. |

**Course Outcomes :**

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

**CO1 :** **Apply** the knowledge of calculus to solve problems related to polar curves and implementation using MATLAB.

**CO2 :** **Apply** the concept of partial differentiation to compute rate of change of multivariate functions and implementation using MATLAB.

**CO3 :** **Apply** the analytical methods to solve first order and first-degree differential equations and implementation using MATLAB.

**CO4 :** **Apply** the analytical methods to solve higher order differential equations and implementation using MATLAB.

**CO5 :** **Apply** matrix theory for solving the system of linear equations, compute eigenvalues and eigenvectors and implementation using MATLAB.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics - I (EEE Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AME1 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of calculus associated with one variable and multivariable arising in engineering.
- **Analyze** and solve engineering problems by applying Ordinary Differential Equations.
- **Demonstrate** the use of analytical and numerical methods to solve the system of linear equations.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### DIFFERENTIAL CALCULUS

Polar curves, angle between he radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in cartesian, polar, parametric and pedal forms. **08 Hrs.**

## UNIT – II

### POWER SERIES EXPANSIONS, INDETERMINATE FORMS AND MULTIVARIABLE CALCULUS

Statement and problems on Taylor's and Maclaurin's series expansion for one variable.

Indeterminate forms - L'Hospital's rule. Partial Differentiation: Partial differentiation, total derivative - differentiation of composite functions. Jacobian. Maxima and minima for a function of two variables. **08 Hrs.**

## UNIT – III

**ORDINARY DIFFERENTIAL EQUATIONS (ODE) OF FIRST ORDER AND FIRST DEGREE AND NONLINEAR ODE**

Exact and reducible to exact differential equations. Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{-1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ only. Linear and Bernoulli's differential equations. Orthogonal trajectories, L-R and C-R circuits.

Non-linear differential equations: Introduction to general and singular solutions, solvable for p only, Clairaut's equations, reducible to Clairaut's equations. **08 Hrs.**

## UNIT – IV

**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER**

Higher-order linear ODEs with constant coefficients, homogeneous and non-homogeneous equations - $e^{ax}$, sin(ax+b), cos(ax+b), $x^n$ only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. L-C-R circuits. **08 Hrs.**

## UNIT - V

**LINEAR ALGEBRA**

Elementary transformations on a matrix, Echelon form, rank of a matrix, consistency of system of linear equations. Gauss elimination, Gauss–Seidel method to solve system of linear equations. Eigen values and eigen vectors of a matrix, Rayleigh power method to determine the dominant eigen value of a matrix. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018. |
| 3 | Gilbert Strang | Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | Srimanta Pal & Subodh C. Bhunia | Engineering Mathematics, Oxford University Press, 3rd Ed., 2016. |
| 3 | N. P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014. |
| 5 | David C Lay | Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018. |

### Course Outcomes :

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

**CO1 :** **Apply** the knowledge of calculus to solve problems related to polar curves and implementation using MATLAB.

**CO2 :** **Apply** the concept of partial differentiation to compute rate of change of multivariate functions and implementation using MATLAB.

**CO3 :** **Apply** the analytical methods to solve first order and first-degree differential equations and implementation using MATLAB.

**CO4 :** **Apply** the analytical methods to solve higher order differential equations and implementation using MATLAB.

**CO5 :** **Apply** matrix theory for solving the system of linear equations, compute eigenvalues and eigenvectors and implementation using MATLAB.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics - II (Civil Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMC2 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of Integral calculus and Vector calculus.
- **Analyze** the engineering problems applying Partial Differential Equations.
- **Develop** the numerical schemes to solve algebraic, transcendental and differential Equations.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### INTEGRAL CALCULUS

**Multiple Integrals:** Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral.

**Beta and Gamma functions:** Definitions, properties, relation between Beta and Gamma functions. **08 Hrs.**

## UNIT - II

### PARTIAL DIFFERENTIAL EQUATIONS

Formation of PDEs by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of Separation of variables. Application of PDE: Derivation of one-dimensional heat equation and wave equation. **08 Hrs.**

## UNIT - III

### VECTOR CALCULUS

Scalar and vector fields. Gradient, directional derivative, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.

**Vector Integration:** Line integrals, work done by a force and flux, Statements of Green's theorem and Stoke's theorem, problems without verification.**08 Hrs.**

## UNIT - IV

**NUMERICAL METHODS - 1**

**Solution of algebraic and transcendental equations:** Regula-Falsi and Newton-Raphson methods, problems.

**Interpolation:** Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula.

Numerical integration: Trapezoidal, Simpson's 1/3rd and 3/8th rules. **08 Hrs.**

## UNIT - V

**NUMERICAL METHODS - 2**

Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector method and Adams-Bashforth predictor-corrector method. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018. |
| 3 | M.K. Jain, S.R.K. Iyengar and R.K. Jain | Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | Srimanta Pal & Subodh C. Bhunia | Engineering Mathematics, Oxford University Press, 3rd Ed., 2016. |
| 3 | N.P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014. |
| 5 | Steven V. Chapra and Raymond P. Canale | Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011. |

| | | |
|---|---|---|
| 6 | Richard L. Burden, Douglas J. Faires and A. M. Burden | Numerical Analysis, 10th Ed., 2010, Cengage Publishers. |
| 7 | S.S. Sastry | Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed., 2012. |

**Course Outcomes :**

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

**CO1 :** **Apply** the concepts of integral calculus to model and solve problems in civil engineering applications using MATLAB.

**CO2 :** **Apply** the concept of partial differentiation to compute rate of change of multivariate functions and implementation using MATLAB.

**CO3 :** **Apply** the concept of vector calculus to verify the vector as solenoidal or irrotational. Demonstrate the use of curvilinear coordinates.

Implementation using MATLAB.

**CO4 :** **Apply** numerical techniques to solve algebraic and transcendental equations and to perform interpolation and numerical integration.

Implementation using MATLAB.

**CO5 :** **Apply** appropriate numerical methods to find approximate solutions of ordinary differential equations and implementation using MATLAB.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics - II
# (Computer Science & Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMS2 |

**Course Objectives :** The course will enable students to :

- **Understand** and quantify the errors.
- **Develop** the numerical schemes to solve transcendental and differential equations.
- **Demonstrate** the application of interpolation.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### INTRODUCTION TO NUMERICAL METHODS

**Errors and their computation:** Round off error, Truncation error, Absolute error, Relative error and Percentage error.

**Solution of algebraic and transcendental equations:** Bisection, Regula-Falsi, Secant and Newton-Raphson methods. **08 Hrs.**

## UNIT – II

### NUMERICAL SOLUTIONS FOR SYSTEM OF LINEAR EQUATIONS

**Norms:** Vector norms and Matrix norms-L1, L2 and L∞, Ill conditioned linear system, condition number.

**Solution of system of linear equations:** Gauss Seidel method and LU-decomposition method.

**Eigenvalues and Eigen vectors:** Rayleigh power method, Jacobi's method.

**08 Hrs.**

## UNIT - III

### INTERPOLATION

Finite differences, interpolation using Newton Gregary forward and Newton Gregary backward difference formulae, Newton's divided difference. Lagrange interpolation formulae, piecewise interpolation-linear and quadratic. **08 Hrs.**

## UNIT - IV

**DIFFERENTIAL EQUATIONS OF FIRST AND HIGHER ORDER**

Linear and Bernoulli`s differential equations. Exact and reducible to exact differential equations with integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $-\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$.

Homogeneous and non-homogeneous differential equations of higher order with constant coefficients. Inverse differential operators – $e^{ax}$, sin(ax+b), cos(ax+b) and $x^n$. **08 Hrs.**

## UNIT - V

**NUMERICAL INTEGRATION AND NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS**

**Numerical integration:** Trapezoidal, Simpson's 1/3 rd, Simpson's 3/8th rule and Weddle's rule.

Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | M.K. Jain, S.R.K. Iyengar and R.K. Jain | Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022. |
| 2 | David C Lay | Linear Algebra and its Applications, Pearson Publishers, 5th Ed., 2023. |
| 2 | B.S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |
| 2 | N.P. Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 3 | S.S. Sastry | Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed. 2012 |
| 4 | Steven V. Chapra and Raymond P. Canale | Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011. |
| 5 | Richard L. Burden, Douglas J. Faires, A. M. Burden | Numerical Analysis, 10th Edition., 2010, Cengage Publishers. |

## Course Outcomes :

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

**CO1 :** **Apply** numerical techniques to solve algebraic and transcendental equations and implementation using MATLAB.

**CO2 :** **Apply** analytical and numerical techniques to solve system of linear equations and implementation using MATLAB.

**CO3 :** **Apply** numerical techniques to perform interpolation and implementation using MATLAB.

**CO4 :** **Apply** analytical techniques to solve ordinary differential equations and implementation using MATLAB.

**CO5 :** **Apply** numerical technique for integration and IVP and implementation using MATLAB.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics – II
# (Mechanical Engineering Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AMM2 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of Integral calculus and Vector calculus.
- **Develop** the numerical schemes to solve algebraic, transcendental and differential Equations.
- **Analyze** and solve engineering problems by applying Ordinary Differential Equations.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### INTEGRAL CALCULUS

**Multiple Integrals:** Definition, Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral.

**Beta and Gamma functions:** Definitions, properties, relation between Beta and Gamma functions. **08 Hrs.**

## UNIT - II

### PARTIAL DIFFERENTIAL EQUATIONS (PDE)

Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of Separation of variables. Application of PDE: Derivation of one-dimensional heat equation and wave equation. **08 Hrs.**

## UNIT – III

### VECTOR CALCULUS

Scalar and vector fields. Gradient, directional derivative, divergence and curl-physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.

**Vector Integration:** Line integrals, work done by a force and flux. Statement of Green's theorem and stoke's theorem and problems without verifications.

**08 Hrs.**

## UNIT – IV

**NUMERICAL METHODS - 1**

**Solution of algebraic and transcendental equations:** Regula – Falsi and Newton-Raphson methods. Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula.

**Numerical integration:** Trapezoidal, Simpson's 1/3$^{rd}$ and 3/8$^{th}$ rules. **08 Hrs.**

## UNIT – V

**NUMERICAL METHODS – 2**

Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector formula and Adams-Bashforth predictor-corrector method. **08 Hrs.**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44$^{th}$ Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10$^{th}$ Ed., 2018. |
| 3 | M. K. Jain, S. R. K. Iyengar and R. K. Jain | Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8$^{th}$ Ed., 2022**.** |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11$^{th}$ Ed., 2017. |
| 2 | Srimanta Pal & Subodh C. Bhunia | Engineering Mathematics, Oxford University Press, 3$^{rd}$ Ed., 2016. |
| 3 | N.P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10$^{th}$ Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3$^{rd}$ Ed., 2014. |
| 5 | Ray Wylie, Louis C. Barrett | Advanced Engineering Mathematics, Mc Graw Hill Book Co., New York, 6$^{th}$ Ed., 2017. |

| | | |
|---|---|---|
| 6 | Steven V. Chapra and Raymond P. Canale | Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011. |
| 7 | Richard L. Burden, Douglas J. Faires and A. M. Burden | Numerical Analysis, 10th Ed., 2010, Cengage Publishers. |
| 8 | S. S. Sastry | Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012. |

**Course Outcomes :**

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

**CO1 :** **Apply** the concepts of integral calculus to model and solve problems in engineering applications using MATLAB.

**CO2 :** **Apply** the analytical methods to solve partial differential equations.

**CO3 :** **Apply** the concept of vector calculus to verify the vector as solenoidal or irrotational. Demonstrate the use of line integral, Greens and stokes theorem. Implementation using MATLAB.

**CO4 :** **Apply** numerical techniques to solve algebraic and transcendental equations and to perform interpolation and numerical integration. Implementation using MATLAB.

**CO5 :** **Apply** apropriate numerical methods to find approximate solutions of ordinary differential equations and implementation using MATLAB.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Applied Mathematics - II (EEE Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+2(T)+0(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 20 | SEE Marks | : | 50 |
| Total Practical Hours | : | | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | AME2 |

**Course Objectives :** The course will enable students to :

- **Familiarize** the importance of Integral calculus and Vector calculus.
- **Develop** the numerical schemes to solve algebraic, transcendental and differential Equations.
- **Demonstrate** the use of Laplace Transform to solve initial value problems.
- **Utilize** a modern tool MATLAB for computation and visualization.

## UNIT - I

### INTEGRAL CALCULUS AND ITS APPLICATIONS

**Multiple Integrals:** Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals.

**Beta and Gamma functions:** Definitions, properties, relation between Beta and Gamma functions. **08 Hrs.**

## UNIT - II

### VECTOR CALCULUS AND ITS APPLICATIONS

**Vector Differentiation:** Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.

**Vector Integration:** Line integrals, Statement of Green's and Stokes' theorem without verification problems. **08 Hrs.**

## UNIT – III

### NUMERICAL METHODS - 1

**Solution of algebraic and transcendental equations:** Regula-Falsi method and Newton-Raphson method.

**Finite Differences and Interpolation:** Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.

**Numerical Integration:** Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8th rule. **08 Hrs.**

## UNIT – IV

**NUMERICAL METHODS - 2**

Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor corrector method and Adam-Bashforth predictor-corrector method. **08 Hrs.**

## UNIT – V

**LAPLACE TRANSFORM**

**Laplace transform (LT):** Definition and Formulae of Laplace Transform, LT of elementary functions. Properties–linearity, scaling, shifting property, differentiation in the s domain, division by t. LT of periodic functions, square wave, saw-tooth wave, triangular wave, full and half wave rectifier, Heaviside Unit step function.

**Inverse Laplace Transforms:** Definition, properties, evaluation using different methods, and applications to solve ordinary differential equations.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | B. S. Grewal | Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021. |
| 2 | E. Kreyszig | Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018. |
| 3 | M. K. Jain, S. R. K. Iyengar and R. K. Jain | Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | B.V. Ramana | Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017. |

| | | |
|---|---|---|
| 2 | Srimanta Pal & Subodh C. Bhunia | Engineering Mathematics, Oxford University Press, 3rd Ed., 2016. |
| 3 | N.P Bali and Manish Goyal | A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022. |
| 4 | H. K. Dass and Er. Rajnish Verma | Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014. |
| 5 | Steven V. Chapra and Raymond P. Canale | Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011. |
| 6 | Richard L. Burden, Douglas J. Faires and A. M. Burden | Numerical Analysis, 10th Ed., 2010, Cengage Publishers. |
| 7 | S. S. Sastry | Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012. |

**Course Outcomes :**

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

**CO1 :** **Apply** the concepts of integral calculus to model and solve problems in engineering applications using MATLAB.

**CO2 :** **Apply** the concept of vector calculus to verify the vector as solenoidal or irrotational. Demonstrate the use of line integral, Greens and stokes theorem. Implementation using MATLAB.

**CO3 :** **Apply** numerical techniques to solve algebraic and transcendental equations and to perform interpolation and numerical integration. Implementation using MATLAB.

**CO4 :** **Apply** appropriate numerical methods to find approximate solutions of ordinary differential equations and implementation using MATLAB.

**CO5 :** **Apply** the Laplace transform method to solve initial value problem and implement using MATLAB

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO2** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO3** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO4** | 3 | 1 | | | 1 | | | | | | | | |
| | **CO5** | 3 | 1 | | | 1 | | | | | | | | |

# Physics for Sustainable Structural Systems for Civil Engineering Stream

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | APC |

**Course Objectives :** This course will enable students :

- Understand the principles of elasticity for designing structures with a solid materials and their mechanical behavior under stress.
- Comprehend different oscillatory systems and to acquire knowledge about interaction between waves and structures.
- Study the acoustics of buildings and the essentials of radiometry and photometry.
- Understand the principles and techniques used in various non-destructive testing (NDT) methods and to understand shock waves, generation, and applications.
- Understand the various relevant material characterization techniques.

## UNIT - I

**ELASTICITY** **08 Hrs.**

Introduction, Elastic materials (qualitative), Hooke's law, Stress-strain curve, Strain hardening and softening. Elastic Moduli, Poisson's ratio and its limiting values. Relations between Young's modulus (Y), rigidity modulus (n), bulk modulus (K) and Poisson's ratio ($\sigma$) (derivation – Y, n and $\sigma$ relation & Y, K and $\sigma$ relation), Beams, Bending moment and expression for bending moment (qualitative). Cantilever, Derivation of expression of Young's modulus of a beam, I section girder and their engineering applications, Failures of engineering materials – Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue (only qualitative explanation). Numerical problems.

**Prerequisites:** Basics of Elasticity.

**Self-learning:** Stress-Strain Curve, Elastic moduli

## UNIT - II

**OSCILLATIONS & WAVES** **08 Hrs.**

**Oscillations:** Simple Harmonic motion (SHM), Characteristics of SHM, Differential equation for SHM. Springs: Stiffness factor and its physical

significance, Series and Parallel combination of springs (Derivation), Types of springs and their applications. Theory of damped oscillations (Qualitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), Resonance, Sharpness of resonance, Numerical Problems.

**Waves and their role in structural behavior:** Types of waves, Wave propagation in beams, rods, and slabs, Boundary effects, Wave dispersion, Damping in structures, Energy dissipation techniques in structures.

**Pre-requisites:** Basics of oscillations

**Self-learning:** Differences between harmonic and un-harmonic oscillations

## UNIT - III

**ACOUSTICS, RADIOMETRY AND PHOTOMETRY 08 Hrs.**

**Acoustics:** Introduction to acoustics, Types of acoustics, Reverberation and reverberation time, Absorption power and Absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), Measurement of absorption coefficient, Factors affecting the acoustics and remedial measures, Sound insulation and its measurements, Noise and its measurements, Impact of noise in multi-storied buildings, Numerical Problems.

**Radiometry and Photometry:** Radiation quantities, Spectral Quantities, Relation between luminescence and Radiant quantities, Reflectance and Transmittance, Photometry (cosine law and inverse square law - Qualitative), Numerical Problems.

**Prerequisites:** Basics of Sound, Waves & light properties

**Self-learning:** Types of acoustics

## UNIT - IV

**NON-DESTRUCTIVE TESTING AND SHOCK WAVES 08 Hrs.**

Introduction to NDT, Needs for inspection, Methods of NDT, Benefits of NDT. Visual inspection, Liquid penetration test: Principle, Basic processing steps of inspection, materials used, advantages and limitations, Eddy current testing: Inspection probes, Display methods, Ultrasonic testing- Ultrasonic flaw detector, - Normal beam pulse-echo, normal beam through transmission, Numerical Problems.

**Shock waves:** Mach number and Mach Angle, Mach Regimes, definition and Characteristics of Shock waves, Construction and working of Reddy shock tube, Role of Shock waves in NDT methods. Numerical problems.

**Prerequisites:** Basics of Ultrasonic.

**Self-learning:** Fundamentals of NDT. Common examination methods.

## UNIT - V

**MATERIAL CHARACTERISATION AND INSTRUMENTATION TECHNIQUES** **08 Hrs**

Introduction to nanomaterials and nanocomposites, surface area to volume ratio, quantum confinement, Optical properties due to quantum confinement, characteristics of composites, metal matrix, ceramic matrix, polymer matrix nanocomposites. Bragg's law, principle, construction and working of X-ray Diffractometer, crystallite size determination by Scherrer equation, Principle, construction, working and applications of Atomic Force Microscope (AFM) and Scanning electron microscope (SEM), Numerical Problems

**Prerequisites:** Fundamental principles of Quantum Mechanics,

**Self-learning:** Nanomaterials, Principles of XRD, AFM, and SEM

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | H M Agarwal and R M Agarwal | Physics, Oscillations and Waves, Optics and Quantum Mechanics, Pearson, 2025 |
| 2 | Satyendra Sharma and Jyotsna Sharma | Engineering Physics, Pearson, 2018 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S L Kakani, Shubra Kakani | Engineering Physics, 3rd Edition, CBS Publishers Pvt. Ltd. 2020 |
| 2 | R K Gaur and S L Gupta | Engineering Physics, edition, Dhanpat Rai Publications Ltd., New Delhi, 2016 |
| 3 | Chintoo S Kumar, K. Takayama and K P J Reddy | Shockwaves Made Simple, Wiley India Pvt. Ltd. New Delhi, 2014 |
| 4 | Sam Zhang, Lin Li, Ashok Kumar | Material Characterization Techniques, CRC Press, First Edition, 2008 |

# List of Experiments

| | |
|---|---|
| 1 | Rigidity modulus by Torsional Pendulum |
| 2 | Determination of Young's modulus using Single Cantilever |
| 3 | Series & Parallel Resonance using LCR circuit |
| 4 | Spring Constant |
| 5 | Wavelength of laser using grating |
| 6 | Verification of Stefan's law |
| 7 | Frequency of AC source using Sonometer |
| 8 | Moment of Inertia of the given irregular body by setting Torsional Oscillations |
| 9 | Reddy shock tube |
| 10 | Resistivity of a wire by four probe method |
| 11 | Verification on Inverse Square Law of Intensity of Light |
| 12 | Determination of wavelength of Ultrasonic using Ultrasonic Interferometer |
| 13 | Determination of Plank's Constant using LEDs. |
| 14 | Data Analysis using Spread Sheets |
| 15 | STEP Interactive Physical Simulations (Springs, Simple Pendulum) / PHET Interactive Simulation |
| **Note:** Any ten experiments to be conducted from the above list by covering one a) Open Ended with spreadsheet activity and b) Simulation | |
| **Manual/Observation book :** | |
| 1 | Engineering Physics Lab Manual prepared by Faculty, Department of Physics, SIT. |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Apply the theory of elasticity to design and evaluate elastic moduli and bending moments of structural beams.

**CO2 :** Analyze the behavior of simple harmonic, damped, and forced oscillatory systems in mechanical contexts and be able to find effective spring constant, frequency of oscillations, damping coefficient and amplitude of oscillation.

**CO3 :** Apply the principles of acoustics, radiometry and photometry to design and evaluate systems of sound, light and radiation measurements.

**CO4 :** Demonstrate knowledge of non-destructive testing (NDT) techniques and select suitable methods for assessing material and structural integrity.

**CO5 :** Elucidate the importance of XRD, AFM and SEM in the area of engineering for structural characterizations of nanomaterials and be able to evaluate surface-to-volume ratio, crystallite size and interplanar spacing of crystal.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 2 | 2 | | | | | | | | | | | |
| | **CO2** | 2 | 2 | | | | | | | | | | | |
| | **CO3** | 2 | 3 | | | | | | | | | | | |
| | **CO4** | 3 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 3 | | | | | | | | | | | |

# Quantum Physics and Applications
# (For CS, CI, IS and BT Branches)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | APS |

**Course Objectives :** This course will enable students :

- Understand principles of quantum mechanics and its applications in quantum computing.
- Analyze the electrical properties of metals/semiconductors using classical and quantum models.
- Explore superconductivity principles, phenomena, and applications in quantum systems.
- Explain light-matter interaction and the working of photonic devices like lasers & optical fibers.
- Comprehend basic quantum computing concepts and predict simple quantum circuit outcomes.

## UNIT - I

**QUANTUM MECHANICS** **08 Hrs.**

deBroglie hypothesis of Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase velocity and Group velocity (only concept), Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Time independent Schrodinger wave equation, Wave Function, Physical Significance of a wave function and Born Interpretation, Eigen functions and Eigen Values, Motion of a particle in a one dimensional potential well of infinite depth, Waveforms and Probabilities, Numerical Problems.

**Prerequisites:** Dual nature of matter.

**Self-learning:** deBroglie Hypothesis

## UNIT - II

**ELECTRICAL PROPERTIES OF METALS & SEMICONDUCTORS** **08 Hrs.**

Assumptions of classical free electron theory, Failures of classical free electron theory, Mechanisms of electron scattering in solids, Matheissen's rule, Assumptions of Quantum Free Electron Theory, Density of States (qualitative), Fermi Dirac statistics, Fermi Energy, Variation of Fermi Factor

with Temperature and Energy, Types of semiconductors – Intrinsic and extrinsic semiconductor, Derivation of electron concentration in intrinsic semiconductor, Expression for intrinsic carrier concentration, Expression for electron and hole concentration in extrinsic semiconductor (qualitative), Fermi level for intrinsic and extrinsic semiconductor (qualitative), Hall effect in semiconductor, Expression for Hall coefficient and Hall voltage, Applications of Hall effect, Numerical Problems.

**Prerequisites:** Basics of electrical conductivity.

**Self-learning:** Success of QFET

## UNIT - III

**SUPERCONDUCTIVITY** **08 Hrs.**

Introduction to superconductors, Temperature dependence of resistivity, Critical temperature, Critical field, Meissner effect, Critical current, Types of super conductors, Temperature dependence of critical field, BCS theory (qualitative), Limitations of BCS theory, High temperature superconductivity, Quantum tunneling (qualitative), Josephson Junction, Flux quantization, DC and AC SQUIDs (qualitative), Applications in quantum computing. Numerical Problems.

**Prerequisites:** Basics of electrical conductivity

**Self-learning:** Tunneling Effect

## UNIT - IV

**PHOTONICS** **08 Hrs.**

Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Requisites of a laser system, Condition for Laser Action, Semiconductor diode Laser, Applications - Bar code scanner, Laser Printer. Numerical Problems.

Optical fiber - Principle and construction, Derivation of Numerical aperture, V-number, Number of modes, Attenuation and its mechanisms (qualitative). Application - Optical fiber communication, Numerical problems.

**Prerequisites:** Properties of light

**Self-learning:** Propagation Mechanism &TIR in optical fiber

## UNIT - V

**QUANTUM COMPUTING** **08 Hrs.**

Matrices - Row and Column matrices and their multiplication (Inner product), Conjugate and transpose of a matrix, Unitary matrix (*U*). Concepts of Hilbert's space, Dirac (Ket and Bra) notation, and Matrix form of wave function. Identity Operator, Determination of I|0> and I|1>. Pauli Matrices and its operations on |0> and |1> states.

Introduction to Quantum Computing, Concept of Qubit - Bloch Sphere, properties, Difference between bit and qubit. Differences between classical & quantum computing. Moore's law - limitation of VLSI.

Single Qubit Gates: Quantum Not Gate, Pauli - Z Gate, Hadamard Gate, Two Qubit Gate: Controlled NOT Gate. Predicting the outputs of various combinations of single and two-qubit gates. Numerical Problems.

**Prerequisites:** Basics of Matrices, Classical computing, Concept of bit

**Self-learning:** Moore's law

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Satyendra Sharma & Jyotsna Sharma | Engineering Physics, Pearson, 2018 |
| 2 | S L Kakani, Shubra Kakani | Engineering Physics, CBS Publishers and Distributers Pvt. Ltd., 3rd Edition, 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | H M Agarwal and R M Agarwal | Physics, Oscillations and Waves, Optics and Quantum Mechanics, Pearson, 2025 |
| 2 | M. N. Avadhanulu, P. G. Kshirsagar and TVS Arun Murthy | A Text book of Engineering Physics, 11th Revised Ed, S. Chand & Company Ltd, New Delhi, 2022 |
| 3 | Mishra, P. K. | Superconductivity – Basics and Applications. Ane Books, 2009 |
| 4 | Parag K Lala | Quantum Computing, McGraw Hill, 2020 |
| 5 | S. O. Pillai | Solid State Physics, New Age International, 2020 |

## List of Experiments

| | |
|---|---|
| 1 | Determination of wavelength of LASER using Diffraction Grating |
| 2 | Determination of acceptance angle and numerical aperture of the given Optical Fiber |
| 3 | Study the Characteristics of a Photo-Diode and to determine the power responsivity |
| 4 | Determination of Planck's Constant using LEDs |
| 5 | Verification of Stefan's law |
| 6 | Determination of Fermi Energy of Copper |
| 7 | Determination of Energy gap of the given Semiconductor |
| 8 | Black-Box Experiment (Identification of basic Electronic Components) |

| | |
|---|---|
| 9 | Resonance in LCR circuit |
| 10 | Characteristics of a Bipolar Junction Transistor |
| 11 | Determination of resistivity of a semiconductor by Four Probe Method |
| 12 | Predicting the outputs of various combinations of single and two-qubit gates using QUIRK Quantum Simulator |
| 13 | Predicting the outputs of various combinations of single and two-qubit gates using QUISKIT |
| 14 | Air-wedge / Newtons to study the interference by the division of amplitude |
| 15 | Data Analysis using Spread Sheet |
| **Note:** Any TEN experiments to be conducted from the above list by covering one a) Open Ended experiment with spreadsheet activity and b) Simulation. | |
| **Manual/Observation book :** | |
| 1 | Engineering Physics Lab Manual prepared by Faculty, Department of Physics, SIT. |

**Course Outcomes :**

Upon completion of this course, students will be able to :

**CO1 :** Apply the basics of quantum mechanics to show nonexistence of electrons in the nucleus and to solve the problems on de Broglie wavelength, uncertainty in position, energy, and particle in a potential well.

**CO2 :** Apply the concepts of classical and quantum free electron theory to find Fermi factor , concentration of charge carriers, as well as Hall coefficient, Hall voltage for the semiconductor.

**CO3 :** Apply the theory of superconductivity to find the critical temperature and critical field for superconducting state of the materials.

**CO4 :** Apply the theory of LASERs and optical fiber to solve the problems on condition of laser action, power of laser, numerical aperture and attenuation coefficient of optical fiber.

**CO5 :** Apply the knowledge of quantum theory in quantum computation and able to find the output of quantum circuits having single and multiple qubit gates.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 3 | | | | | | | | | | | |
| | **CO2** | 3 | 2 | | | | | | | | | | | |
| | **CO3** | 3 | 2 | | | | | | | | | | | |
| | **CO4** | 2 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 3 | | | | | | | | | | | |

# Physics of Materials
# (For ME, IEM, and CH Branches)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | APM |

**Course Objectives :** This course will enable students :

- Understand the principles of elasticity for designing structures with a solid materials and their mechanical behavior under stress.
- Comprehend the theoretical background of lasers, the working of He-Ne laser and the applications of laser. Also, study the nature of light propagation in optical fiber, reasons for the fiber loss and applications of optical fiber.
- Elucidate the types of oscillation, shock waves & its generation, and applications.
- Understand the principles, materials, design and operation of thermoelectric devices for energy conversion and temperature control.
- Comprehensive understanding of materials characterization techniques, analyze and interpret properties and structure of materials.

## UNIT - I

**ELASTICITY** **08 Hrs.**

Introduction, Hooke's law, Review of Stress-Strain curve, Strain hardening and softening, Elastic Moduli, Poisson's ratio, Relation between Young's modulus (Y), rigidity modulus (n), and Poisson's ratio ($\sigma$) and relation between Y, bulk modulus (K) and $\sigma$ (with derivation), Limiting values of Poisson's ratio, Static and dynamic loading, Beams, Bending moment and its expression (qualitative), Cantilever – Derivation of expression of Young's modulus of a beam, Torsion and Expression for couple per unit twist (qualitative), Elastic materials (qualitative). Failures of engineering materials - Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue (only qualitative explanation), S-N Curve, Numerical problems.

**Prerequisites:** Basics of Elasticity.

**Self-learning:** Stress-Strain Curve, Elastic moduli

## UNIT - II

**LASER AND OPTICAL FIBER** **08 Hrs.**

**Lasers:** Introduction, characteristics of LASER, and difference between laser light and ordinary light. Concept of induced absorption, spontaneous emission and stimulated emission. Expression for energy density in terms of Einstein's coefficients and discussion of results. Requisites of lasers. Condition for laser action. Construction and working of He-Ne laser, Material processing with laser beam: Surface modification, surface hardening, drilling, welding, cutting. Numerical Problems.

**Optical fibers:** Structure of optical fiber, working principle, Light propagation mechanism - angle of acceptance, numerical aperture, Expression for numerical aperture, Attenuation, and mechanisms for fiber loss (qualitative). Applications of Optical Fibers - Fiber Optic displacement sensor and Pressure sensor, Numerical Problems.

**Prerequisite:** Properties of light,

**Self-learning:** Difference between laser and ordinary light, Principle of optical fiber

## UNIT - III

**OSCILLATIONS and SHOCK WAVES** **08 Hrs.**

Simple Harmonic motion (SHM), Characteristics of SHM, Differential equation for SHM. Springs: Stiffness factor and its physical significance, Series and Parallel combination of springs (Derivation), Types of springs and their applications. Theory of damped oscillations (qualitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (qualitative), Resonance, Sharpness of resonance, Numerical Problems.

**Shock waves:** Mach number and Mach Angle, Mach Regimes, definition and Characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves, Numerical problems.

**Pre-requisites:** Basics of oscillations

**Self-learning:** Differences between harmonic and un-harmonic oscillations, Basics of SHM

## UNIT - IV

**THERMOELECTRIC MATERIALS AND DEVICES** **08 Hrs.**

Thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, Figure of merit (Mention Expression), Laws of thermoelectricity. Expression for thermo emf in terms of $T_1$ and $T_2$, Thermo couples, Thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), Low, Mid and High temperature thermoelectric materials, Applications: Exhaust of Automobiles, Refrigerator, Space Program (Radioisotope Thermoelectric Generator (RTG), Numerical Problems

**Prerequisites:** Basics of thermoelectricity

**Self-learning:** Thermo emf and thermo current

## UNIT - V

**MATERIAL CHARACTERISATION AND INSTRUMENTATION TECHNIQUES** **08 Hrs.**

Introduction to nanomaterials and nanocomposites, surface area to volume ratio, quantum confinement, Optical properties due to quantum confinement, characteristics of composites, metal matrix, ceramic matrix, polymer matrix nanocomposites. Bragg's law, principle, construction and working of X-ray Diffractometer, crystallite size determination by Scherrer equation, Principle, construction, working and applications of Atomic Force Microscope (AFM) and Scanning electron microscope (SEM), Numerical Problems

**Prerequisites:** Fundamental principles of Quantum Mechanics,

**Self-learning:** Nanomaterials, Principles of XRD, AFM, XPS and SEM.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | H M Agarwal and R M Agarwal | Physics, Oscillations and Waves, Optics and Quantum Mechanics, Pearson, 2025 |
| 2 | Satyendra Sharma and Jyotsna Sharma | Engineering Physics, Pearson, 2018 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S L Kakani, Shubra Kakani | Engineering Physics, 3rd Edition, CBS Publishers Pvt. Ltd. 2020 |
| 2 | Chintoo S Kumar, | Shockwaves Made Simple, Wiley India Pvt. |

| | | |
|---|---|---|
| | K. Takayama and K P J Reddy | Ltd. New Delhi, 2014 |
| 3 | Sam Zhang, Lin Li, Ashok Kumar | Material Characterization Techniques, CRC Press, First Edition, 2008 |
| 4 | Hitendra K. Singh and A. K. Singh | Engineering Physics, Tata McGraw Hill, New Delhi, 2010 |

## List of Experiments

| | |
|---|---|
| 1 | Rigidity modulus of the material of the wire using Torsional Pendulum |
| 2 | Young's modulus of the material of the given bar using Single Cantilever |
| 3 | Series & Parallel Resonance using LCR circuit |
| 4 | Spring Constant |
| 5 | Wavelength of laser using grating |
| 6 | Numerical aperture and fiber loss |
| 7 | Study the working of Peltier Modules |
| 8 | Verification of Stefan's law |
| 9 | Determination of Plank's Constant using LEDs |
| 10 | Frequency of AC source using Sonometer |
| 11 | Moment of Inertia of the given irregular body by setting Torsional Oscillations |
| 12 | Reddy shock tube |
| 13 | Resistivity of a wire by four probe method |
| 14 | STEP Interactive Physical Simulations. (Springs, Simple Pendulum) / PHET Interactive Simulation |
| 15 | Data Analysis using Spread Sheet |
| **Note:** Any ten experiments to be conducted from the above list by covering one a) open ended experiment with spreadsheet activity and b) simulation. | |
| **Manual/Observation book :** | |
| 1 | Engineering Physics Lab Manual prepared by Faculty, Department of Physics, SIT. |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Apply the theory of elasticity to design and evaluate elastic moduli and bending moments of structural beams.

**CO2 :** Apply the theory of LASERs and optical fiber to solve the problems on condition of laser action, power of laser, numerical aperture and attenuation coefficient of optical fiber.

**CO3 :** Analyze the behavior of damped and forced oscillatory systems in mechanical contexts and be able to find effective spring constant, frequency of oscillations, damping coefficient and amplitude of oscillation.

**CO4 :** Analyze thermoelectric phenomena, device construction, and identify suitable materials and applications for energy conversion.

**CO5 :** Elucidate the importance of XRD, AFM and SEM in the area of engineering for structural characterizations of nanomaterials and be able to evaluate surface-to-volume ratio, crystallite size and interplanar spacing of crystal.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 2 | | | | | | | | | | | |
| | **CO2** | 3 | 3 | | | | | | | | | | | |
| | **CO3** | 3 | 2 | | | | | | | | | | | |
| | **CO4** | 2 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 3 | | | | | | | | | | | |

# Electrical Engineering Materials
# (For EEE Branch)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | APEE |

**Course Objectives :** This course will enable students :

- Understand the properties of dielectrics and magnetic materials.
- Know the thermal properties of materials and their applications relevant to engineering.
- Analyse the electrical properties of metals using classical and quantum models.
- Study the concept of band formation in solids and Hall Effect.

## UNIT - I

**DIELECTRIC AND MAGNETIC MATERIALS** **08 Hrs.**

**Dielectrics:** Introduction – Dielectrics, Solid, Liquid and Gaseous dielectrics, Polar and non-polar dielectrics, Electrical Polarization Mechanisms, Internal fields in solids (qualitative), Clausius-Mossotti relation, (Derivation) and its implications, Frequency dependence of Dielectric constant, Dielectric loss. Applications of dielectrics in Capacitors, Transformers, Numerical Problems.

**Magnetic material:** Classification of magnetic materials, Hysteresis curve and explanation using Domain theory, Hard and soft magnetic materials, Applications - Transformer Cores, magnetic data storage, Numerical Problems.

**Pre-requisites**: Basics of dielectrics and magnetic materials.

**Self-learning**: Electric dipolemoment, Bohr magneton.

## UNIT - II

**THERMOELECTRIC MATERIALS AND DEVICES** **08 Hrs.**

Thermo emf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Expression for thermo emf in terms of T1 and T2, Thermo couples, thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature

thermoelectric materials, Applications: Exhaust of Automobiles, Refrigerator, Space Program (Radioisotope Thermoelectric Generator), Numerical Problems

**Prerequisites**: Basics of thermal conductivity

**Self-learning**: Thermo emf, thermo current

## UNIT - III

**ELECTRICAL PROPERTIES OF METALS** **08 Hrs.**

Assumptions of classical free electron theory, drift velocity, relaxation time, collision time, Expression for electrical conductivity, mobility of electrons, Mechanisms of electron scattering in solids, Matheissen's rule, Failures of classical free electron theory. Assumptions of Quantum Free Electron Theory, Density of States (qualitative), Fermi Energy (qualitative), Expression of Fermi energy in terms of resistivity of a wire, significance of Fermi energy, Fermi Dirac statistics, Variation of Fermi Factor with Temperature, Fermi velocity, Fermi mean free path, Fermi temperature, Success of quantum free electron theory, concept of perfect conductor, Failures of QFE theory, Numerical Problems.

**Prerequisites:** Basics of electrical properties

**Self-learning:** Electrical conductivity

## UNIT - IV

**SEMICONDUCTORS** **08 Hrs.**

Classification of solids based on the formation of bands due to splitting of energy levels at equilibrium inter-nuclear distance: metal (Na & Mg), insulator (diamond) and semiconductor (Si). Types of semiconductors – Intrinsic and extrinsic semiconductor, Derivation of electron concentration in intrinsic semiconductor, Expression for intrinsic carrier concentration, Expression for electron and hole concentration in extrinsic semiconductor (qualitative), Fermi level for intrinsic and extrinsic semiconductor (qualitative), Expression for electrical conductivity of a semiconductor. Hall effect in semiconductor, Expression for Hall coefficient and Hall voltage, Applications of Hall effect, Numerical Problems.

**Prerequisites:** Basics of semiconductor

**Self-learning:** Effective mass

## UNIT - V

**SUPERCONDUCTIVITY** **08 Hrs.**

Introduction to superconductors, Temperature dependence of resistivity, Critical temperature, Critical magnetic field, Meissner effect, Critical current, Temperature dependence of critical field, BCS theory (qualitative), Types of super conductors, High temperature superconductivity, Limitations of BCS theory, Quantum tunneling (qualitative), Josephson Junction, Flux quantization, DC SQUIDs (qualitative), Applications - superconducting magnet, Maglev Vehicle, Numerical Problems.

**Prerequisites:** Basics of electrical conductivity

**Self-learning:** Tunnelling Effect

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | M. N. Avadhanulu, P. G. Kshirsagar and TVS Arun Murthy | A Textbook of Engineering Physics, 11th revised Ed, S. Chand & Company Ltd, New Delhi, Reprint 2022 |
| 2 | S L Kakani, Shubra Kakani | Engineering Physics, 3rd Edition, CBS Publishers and Distributers Pvt. Ltd, 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S Mani Naidu | Engineering Physics, Pearson, Fourteenth Impression, 2024 |
| 2 | S. O. Pillai | Solid State Physics, 8th Ed- New Age International Publishers-2018 |
| 3 | Mishra, P. K. | Ane Books, 2009 |
| 4 | Gaur and Gupta | Engineering Physics, Dhanpat Rai Publications, 2017 |
| 5 | R. K. Shukla | Electrical Engineering Materials, Tata Mcgraw-Hill Education, India, 2017 Reprint Edition. |
| 6 | Satyendra Sharma and Jyotsna Sharma | Engineering Physics, Pearson, 2018 |

# List of Experiments

| | |
|---|---|
| 1 | Determination of the dielectric constant of the material of a capacitor by Charging and Discharging Method. |
| 2 | Study the characteristics of a Photo-Diode and determine the power responsivity. |
| 3 | Study the frequency response of Series & Parallel LCR circuits. |
| 4 | Determination of the Fermi Energy of Copper. |
| 5 | Determination of resistivity of a semiconductor by Four Probe Method. |
| 6 | B-H Curve |
| 7 | Thermo-emf or Peltier Module |
| 8 | Identification of Electronic and Electrical Components & Determination of Value – Black Box |
| 9 | Energy Gap of a Semiconductor |
| 10 | I-V Characteristics of a Bipolar Junction Transistor. |
| 11 | I-V Characteristics of a Zener diode. |
| 12 | Determination of the wavelength of semiconductor laser using Diffraction Grating. |
| 13 | Construction and Analyzing Electronic circuits (Expeyes Simulator / circuit lab) |
| 14 | Light Emitting Diode |
| 15 | Data Analysis using Spread Sheet |
| **Note:** Any ten experiments to be conducted from the above list by covering one a) Open Ended experiment with spread sheet and b) Simulation / circuit lab. | |
| **Manual/Observation book :** | |
| 1 | Engineering Physics Lab Manual prepared by Faculty, Department of Physics, SIT. |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Apply the theory of dielectrics to find dielectric constant, polarizability of the materials and be able to elucidate the applications of hard and soft magnetic materials for engineering applications.

**CO2 :** Analyze thermoelectric phenomena, device construction, and identify suitable materials and applications for energy conversion.

**CO3 :** Evaluate electrical transport mechanisms in metals using classical and quantum models and perform relevant calculations.

**CO4 :** Apply the concepts of semiconductors to find mobility of charge carriers, conductivity of the materials, type and concentration of charge carriers in the semiconductor, Hall coefficient and Hall voltage.

**CO5 :** Apply the theory of superconductivity to find critical temperature and critical field for superconducting state of the materials.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 3 | | | | | | | | | | | |
| | **CO2** | 3 | 2 | | | | | | | | | | | |
| | **CO3** | 3 | 2 | | | | | | | | | | | |
| | **CO4** | 2 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 3 | | | | | | | | | | | |

# Quantum Physics and Electronics Sensors (For EC, EI and ET Branches)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | APEC |

**Course Objectives :** This course will enable students :

- Study the principles of quantum mechanics.
- Analyze the electrical properties of metals and semiconductors using classical and quantum models.
- Explore superconductivity principles, phenomena, and their applications.
- Explain light-matter interaction and the working of photonic devices like lasers & optical fibers.
- Demonstrate the principles, characteristics, and applications of semiconductor devices.

## UNIT - I

**QUANTUM MECHANICS** **08 Hrs.**

de Broglie hypothesis of Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase velocity and Group velocity (only concept), Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Wave Function, Time independent Schrodinger wave equation, Physical Significance of a wave function and Born Interpretation, Eigen functions and Eigen Values, Motion of a particle in a one dimensional potential well of infinite depth, Waveforms and Probabilities. Numerical Problems

**Prerequisites:** Dual nature of matter.

**Self-learning:** deBroglie Hypothesis

## UNIT - II

**ELECTRICAL PROPERTIES OF METALS & SEMICONDUCTORS** **08 Hrs.**

Assumptions of classical free electron theory, Failures of classical free electron theory, Mechanisms of electron scattering in solids, Matheissen's rule, Assumptions of Quantum Free Electron Theory, Density of States (qualitative), Fermi Dirac statistics, Fermi Energy, Variation of Fermi Factor with Temperature and Energy, Types of semiconductors – Intrinsic and extrinsic semiconductor, Derivation of electron concentration in intrinsic

semiconductor, Expression for intrinsic carrier concentration. Expression for electron and hole concentration in extrinsic semiconductor (qualitative). Fermi level for intrinsic and extrinsic semiconductor (qualitative), Hall effect in semiconductor, Expression for Hall coefficient and Hall voltage, Applications of Hall effect, Numerical Problems.

**Prerequisites:** Basics of electrical conductivity.

**Self-learning:** Types of semiconductor, Success of QFET

## UNIT - III

**SUPERCONDUCTIVITY** **08 Hrs.**

Introduction to superconductors, Temperature dependence of resistivity, Critical temperature, Critical field, Meissner effect, Critical current, Types of superconductors, Temperature dependence of critical field, BCS theory (qualitative), Limitations of BCS theory, High temperature superconductivity, Quantum tunneling (qualitative), Josephson Junction, Flux quantization, DC SQUIDs (qualitative), Applications - superconducting magnet, Maglev Vehicle, Numerical Problems.

**Prerequisites:** Basics of electrical conductivity

**Self-learning:** Tunneling Effect

## UNIT - IV

**PHOTONICS** **08 Hrs.**

**Laser:** Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Requisites of a laser system, Condition for Laser Action, Semiconductor diode Laser, Applications - Bar code scanner, Laser Printer. Numerical Problems.

**Optical fiber** - Principle and construction, Derivation of Numerical aperture, V-number, Number of modes, Attenuation and its mechanisms (qualitative). Application - Optical fiber communication, Numerical problems.

**Prerequisites:** Properties of light

**Self-learning:** Propagation Mechanism &TIR in optical fiber

## UNIT - V

**SEMICONDUCTOR DEVICES AND SENSORS** **08 Hrs.**

Formation of bands due to splitting of energy levels at equilibrium inter-nuclear distance - silicon, Direct and indirect band gap, LED, Photo-Diode, Photo Transistor, Light dependent resistor, Sensing mechanisms, Piezoelectric Sensors, Metal Oxide Semiconductor (MOS) sensors, Hall sensor, Superconducting Nanowire Single Photon Detector, Numerical Problems.

**Prerequisites:** Basics of semiconductors

**Self-learning:** p-n junction and its V-I characteristics

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | M. N. Avadhanulu, P. G. Kshirsagar and TVS Arun Murthy | A Text book of Engineering Physics, 11th Ed, S. Chand & Company Ltd, New Delhi, 2022 |
| 2 | S L Kakani, Shubra Kakani | Engineering Physics, CBS Publishers and Distributers Pvt. Ltd., 3rd Edition, 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | H M Agarwal and R M Agarwal | Physics, Oscillations and Waves, Optics and Quantum Mechanics, Pearson, 2025 |
| 2 | S Mani Naidu | Engineering Physics, Pearson, Fourteenth Impression, 2024 |
| 2 | Mishra. P. K. | Superconductivity – Basics and Applications. Ane Books, 2009 |
| 3 | S. O. Pillai | Solid State Physics, 8th Ed- New Age International Publishers-2018 |
| 4 | B L Theraja | Quantum Computing, McGraw Hill, 2020<br>Basic Electronics, Multi-Colour Edition, S Chand, 2006 |
| 5 | Satyendra Sharma and Jyotsna Sharma | Engineering Physics, Pearson, 2018 |

## List of Experiments

| | |
|---|---|
| 1 | Determination of the wavelength of LASER using Diffraction Grating. |
| 2 | Determination of acceptance angle and numerical aperture of the given Optical Fiber. |
| 3 | Determination of dielectric constant of the material of capacitor by Charging and Discharging method. |
| 4 | Study the Characteristics of a Photo-Diode and to determine the power responsivity |
| 5 | Determination of Plank's Constant using LEDs |
| 6 | Determination of Fermi Energy of Copper |
| 7 | Interference by the division of amplitude (Air-wedge/Newton's Rings) |
| 8 | Black-Box Experiment |

| | |
|---|---|
| 9 | Construction and Analyzing of Electronic circuits (Expeyes Simulator / circuit lab) |
| 10 | Verification of the Inverse Square Law of Intensity of Light |
| 11 | I-V Characteristics of a Bipolar Junction Transistor |
| 12 | I-V Characteristics of a Zener diode |
| 13 | Resonance in LCR circuit |
| 14 | Energy Gap of a Semiconductor |
| 15 | Data analysis using spread sheet |
| **Note:** Any ten experiments to be conducted from the above list by covering one a) Open Ended experiment with spreadsheet activity and b) Simulation/Circuit lab. | |
| **Manual/Observation book :** | |
| 1 | Engineering Physics Lab Manual prepared by Faculty, Department of Physics, SIT. |

**Course Outcomes :**

Upon completion of this course, students will be able to :

**CO1 :** Apply the basics of quantum mechanics to show the nonexistence of electrons in the nucleus and to solve the problems on de Broglie wavelength, uncertainty in position, energy, and particle in a potential well.

**CO2 :** Apply the concepts of quantum free electron theory to find Fermi factor and concentration of charge carriers, Hall coefficient, Hall voltage for the semiconductor.

**CO3 :** Apply the theory of superconductivity to find the critical temperature and critical field for the superconducting state of the materials.

**CO4 :** Apply the theory of LASERs and optical fiber to solve the problems on the condition of laser action, power of laser, numerical aperture and attenuation coefficient of optical fiber.

**CO5 :** Analyze the various semiconductor devices for electronic and photonic applications.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 3 | | | | | | | | | | | |
| | **CO2** | 3 | 2 | | | | | | | | | | | |
| | **CO3** | 3 | 2 | | | | | | | | | | | |
| | **CO4** | 2 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 3 | | | | | | | | | | | |

# Applied Chemistry for Sustainable Structures and Material Design (CV Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | ACC |

**Course Objectives :** This course will enable students :

- Utilize the principles of water quality assessment and analytical techniques to evaluate and interpret water characteristics.
- Apply the understanding of cement quality parameters and implement the concepts of artificial concrete in the context of green building practices.
- Demonstrate proficiency in the synthesis of polymers, polymer composites, nanomaterials and apply their applications in civil engineering structures.
- Understand the properties of metals, alloys and analyze the corrosion phenomena relevant to building construction.
- Employ the construction, working principles, advancements in batteries and emerging energy storage technologies.

## UNIT - I

**WATER CHEMISTRY AND ANALYTICAL TECHNIQUES 08 Hrs.**

**Water quality parameters:** Introduction: Types of water and impurities in water. Water quality parameters: pH, turbidity, dissolved oxygen, chlorides and alkalinity for environmental and construction applications.

**Waste water analysis:** Chemical Oxygen Demand (COD): Definition, determination and numerical problems. Hardness of water: Definition, types and its determination by rapid EDTA method.

**Analytical Techniques:** Potentiometric Sensors: Principle, instrumentation and application in the estimation of iron in industrial effluents (FAS against $K_2Cr_2O_7$). Conductometric Sensors: Principle, instrumentation and applications of conductometric titrations in industrial effluents: Strong acid against strong base and mixture of strong acid and weak acid against a strong base.

**Optical Sensors:** Colorimetry – Principle, instrumentation and numerical problems. Application of colorimetry in the estimation of copper in brass alloy.

## UNIT - II

**CONVENTIONAL & SUSTAINABLE CONSTRUCTION MATERIALS 08 Hrs.**

**Cement:** Introduction, chemical composition and types. Manufacturing of cement by Kiln **process**, Setting and hardening of cement.

**Sustainability issues in cement manufacturing:** Environmental impact of cement – $CO_2$ emissions and energy consumption. Concept of carbon footprint and greenhouse gas mitigation.

**Supplementary Cementitious Materials:** Fly ash and Ground Granulated Blast-furnace Slag (GGBS) - Origin, Chemistry and its applications.

**Green cements and alternatives:** Geopolymer Concrete: Introduction, mechanism of geopolymerization and manufacturing process of geopolymer concrete. Advantages over Ordinary Portland Cement (OPC) concrete.

**Piezoelectric cement composites:** Piezoelectric materials in cement composites and its applications in civil engineering.

**Bioconcrete:** Introduction, self-healing property and advantages.

## UNIT - III

**MATERIALS FOR STRUCTURAL INTEGRITY 08 Hrs.**

**Polymers:** Introduction: Definition and types of polymerization. Molecular weight of polymers: Number and weight average molecular weight of polymers. Numerical problems. Synthesis, properties and engineering applications of PVC, PMMA, Kevlar and Epoxy Resins.

**Biopolymers:** Polylactic acid: Synthesis, properties and its applications.

**Nanomaterials:** Introduction: Definition and classification based on composition. Size dependent properties: Surface area, water absorption and permeability, thermal properties and antimicrobial activity. Synthesis of $TiO_2$ by hydrothermal process. Concrete as composite material and composition of nano-concrete. Industrial applications of carbon-based reinforced composites graphene/carbon nano tube as fillers.

## UNIT - IV

**CORROSION SCIENCE AND SURFACE PROTECTION 08 Hrs.**

**Metals and Alloys:** Introduction, classification of metals: ferrous and non-ferrous. Iron and its alloys: Wrought Iron, Cast Iron, Pig iron and Steel - composition, properties and applications. Aluminum and its alloys: Duralumin and Magnalium - composition, properties, and applications.

**Corrosion:** Introduction, electrochemical corrosion of steel. Types of corrosion - Differential metal corrosion, Differential aeration corrosion – waterline

corrosion and pitting corrosion, and Stress corrosion in civil structures. Corrosion control by coatings: Galvanization and anodization. Corrosion control by cathodic protection: Impressed voltage method and sacrificial anode method. Introduction to corrosion penetration rate. Numerical problems.

**Metal finishing:** Introduction, technological importance of metal finishing, Electroplating of Chromium - Decorative and hard coating.

## UNIT - V

**ENERGY SYSTEMS AND GREEN FUELS** **08 Hrs.**

**Electrochemistry:** Introduction, Electrode potential, Nernst equation (basic overview), Construction and working of concentration cell. Numerical problems on Nernst equation and concentration cell.

**Energy systems:** Introduction: Definition, classification of batteries. Battery characteristics: capacity, power density, cell balancing and cycle life. Construction and working of Lithium-ion battery and its applications.

**Fuel cells:** Definition, difference between battery and fuel cell. Construction, working, and applications of solid-oxide fuel cell.

**Solar Energy:** Construction and working of silicon solar cell. Advantages, applications and limitations.

**Green Fuels:** Introduction, green hydrogen production by $TiO_2$-photocatalytical method and applications.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Suba Ramesh and S. Vairam | Engineering Chemistry - A text book of Chemistry for Engineers. Wiley India 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. S. Dara | A text book of Environmental Chemistry and pollution and pollution control, 2004 |
| 2 | N. Subramanian | **Building Materials.** Oxford Higher Education, 2019.ISBN: 9780199497218, 9780199497218 |
| 2 | Bharath Bhushan | Hand book of nanotechnology, Spinger-Verlag Berlin Heidelberg, New York, 2010 |
| 3 | S.K. Dhawan and Hema Bhandari | Corrosion Preventive Materials and Corrosion Testing, CRC Press, 2020 |
| 4 | Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich | Electrochemical Power Sources Batteries, Fuel Cells, And Supercapacitors. Wiley Publishing Inc. 2015 |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Analyze water quality parameters and metal ion concentration through wet and instrumental methods and modify the quality of water quality by RO.

**CO2 :** Apply the knowledge of chemistry principles to improve the quality of cement, concrete and eco-friendly concrete.

**CO3 :** Identify differences in traditional and advanced polymer/nanocomposites and their influence on engineering applications.

**CO4 :** Implement suitable techniques to control corrosion of ferrous, nonferrous metals, alloys and protect metals through metal finishing process.

**CO5 :** Illustrate the functioning of electrodes, energy storage and conversion systems, such as Li-ion battery, solid-oxide fuel cell and silicon solar cell.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | √ | | | | | | | | | | | | |
| | CO4 | √ | | | | | | | | | | | | |
| | CO5 | √ | | | | | | | | | | | | |

# PRACTICAL MODULE

**Course Objectives :** This course will enable students :

- The use of pH sensor for the determination of $pK_a$ of given soft drinks.
- The construction and use of electrochemical cell as sensor for the determination of emf/concentration of redox species.
- The usage of optical sensors (colorimeter) for the estimation of metals in various matrices.
- The use of conductivity meter for the determination of conductance in electrolytic solutions.
- The application of volumetry in the analysis of water quality parameters.

| | |
|---|---|
| **A – Instrumental Methods of Analysis:** | |
| A1 | Determination of pKa of given sample of soft drink using pH sensor and its graphical interpretation using origin software. |
| A2 | Estimation of iron present in stainless steel using electrochemical sensor and its graphical interpretation using origin software. |
| A3 | Optical sensor for copper determination from e - waste sample (printed circuit board) and its graphical interpretation using origin software. |
| A4 | Estimation of HCl using standard NaOH conductometrically and its graphical interpretation using origin software. |
| **B – Volumetric Methods of Analysis:** | |
| B1 | Determination of total hardness of water for drinking purpose. |
| B2 | Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. |
| B3 | Redox titration – Determination of iron in the given TMT by bars external indicator method. |
| B4 | Determination of CaO in cement by rapid EDTA method. |
| **C – Demonstration Experiments (Any two):** | |
| C1 | Synthesis of nano $SiO_2$ by combustion method. |
| C2 | Determination of alkalinity of water using standard NaOH solution. |
| C3 | Preparation of urea formaldehydye resin. |
| C4 | Determination of viscosity coefficient of a lubricant using Ostwald's viscometer. |
| **D – Open Ended Experiments (Any two):** | |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Arthur I. Vogel | Quantitative Inorganic Analysis and Elementary Instrumental Analysis: ELBS, Longmann Group, 5th Edition, 1989 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Determine the electrode potential of newly constructed electrodes; calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples.

**CO2 :** Estimate the amount of metal(s) in effluents by potentiometer.

**CO3 :** Determine the metals/pollutants in water and alloys using colorimeter.

**CO4 :** Measure the conductance of solutions/electrolytes which in turn can be used for the determination of its characteristics.

**CO5 :** Use the knowledge of volumetric analysis for estimation of metals and water samples.

### Mapping of Course Outcomes with Program outcomes

1. Ability to apply knowledge of science to the engineering problems.
2. Ability to analyze the problems using the principles of science.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | | √ | | | | | | | | | | | |
| | CO4 | | √ | | | | | | | | | | | |
| | CO5 | | √ | | | | | | | | | | | |

# Applied Chemistry for Smart Systems (CSE Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | ACS |

**Course Objectives :** This course will enable students :

- Implement the knowledge of battery and fuel cell construction, operation and applications in the production of hydrogen as a clean energy fuel.
- Learn the art of sensor technology, mechanism of corrosion and its control.
- Master the knowledge of principles of green chemistry, biomaterials, e-waste and their applications, along with the role of chemistry in forensic science.
- Gain knowledge on quantum dots, polymers, photovoltaic cells and its applications in real time sensor technologies.
- To impart foundational knowledge on the structure, mechanistic perspectives of electronic memory and display systems.

## UNIT - I

**SUSTAINABLE CHEMISTRY FOR ENERGY DEVICES** **08 Hrs.**

**Advanced Battery Chemistry:** Introduction, Electrochemical cell and classification. Nernst equation (overview), Concentration cell - Definition, construction & working and numerical problems on Nernst equation and concentration cell. Batteries: Basic concepts, classification of batteries (primary, secondary and reserve batteries).

**Next – Generation Energy Systems:** Introduction, construction and working of commercial batteries like Lithium - ion and Sodium - ion batteries.

**Clean Energy Chemistry:** Introduction, Fuel cell, difference between fuel cell and battery, construction and working of methanol - oxygen fuel cell and Solid-oxide Fuel Cell (SOFCs). **Clean Fuel:** Hydrogen as a clean Fuel, hydrogen production by photocatalytic water splitting using $TiO_2$ and its advantages.

## UNIT - II

**CHEMISTRY OF CHEMICAL SENSORS AND CORROSION TECHNOLOGY** **08 Hrs.**

**Chemical Sensors:** Colorimetry - Principle, instrumentation and application in the estimation of copper and numerical problems.

**Biosensors:** Principle and working mechanism for the detection of glucose in biofluids.

**Electrochemical Sensors:** Potentiometry - Principle, instrumentation and application in redox titration (FAS v/s $K_2Cr_2O_7$). Conductometric Sensors - Principle, instrumentation and application in titrations of strong acid against a strong base, and mixture of acids (strong acid + weak acid) against a strong base.

**Corrosion:** Metallic corrosion, electrochemical theory of corrosion, types of corrosion - differential metal and differential aeration corrosion (waterline and pitting corrosion). Corrosion penetration rate (CPR) - numerical problems. Corrosion control: Metal coatings - Galvanization, Inorganic coatings - Anodization of Alumina. Cathodic protection - Impressed voltage method and Sacrificial anode method.

## UNIT - III

**GREEN MATERIALS AND E-WASTE MANAGEMENT 08 Hrs.**

**Green Chemistry:** Introduction, principles of green chemistry, atom economy - definition and numerical problems. Green synthesis of nano ZnO for magnetic radio frequency identification (RFID) and internet of nanothings (IONT) applications.

**Biomaterials:** Introduction, synthesis, properties and applications of polylactic acid (PLA) and polyethylene glycol (PEG) for touch screen and brain computer interfaces.

**Chemistry in forensic Science:** Definition and its applications (relevant to computer science & engineering).

**E-waste:** Introduction, sources (E - waste items), toxic materials used in the manufacturing electronic and electrical products, problem of E - waste on environment and human health, solution for E - waste, methods of disposal, advantages of recycling. Extraction of gold from E - waste via hydrometallurgy.

## UNIT - IV

**ADVANCED CHEMISTRY: QUANTUM MATERIALS & POLYMERS 08 Hrs.**

**Quantum dots:** Introduction, size dependent properties (Quantum confinement effect, Surface-to-volume ratio & Band gap). Solar Cells: Definition with principle, construction, working and applications of Quantum Dot Sensitized Solar Cells (QDSSC's).

**Polymers:** Definition, classification - based on occurrence, structure and effect of heat on polymers (thermoplastic and thermosetting polymers). Number average and weight average molecular weight - Definition and

numerical problems. Synthesis, properties and applications of PVC & PMMA for device applications.

**Conducting polymers:** Definition, mechanism of conduction in polyacetylene (oxidative doping). Synthesis and applications of Polyaniline.

## UNIT - V

**FUNCTIONAL MATERIALS IN MEMORY & DISPLAY SYSTEMS 08 Hrs.**

**Memory Devices:** Introduction, basic structure (concept) of electronic memory devices, classification of electronic memory devices: based on principle of electronic material used (transistor type, capacitor type, resistor type, charge transfer complex type). Based on the type of material used (organic and inorganic memory devices).

**Resistive Ram (ReRAM) materials:** Introduction, synthesis of nano ZnO by combustion method and nano $TiO_2$ by hydrothermal method.

**Display Systems:** Introduction, Liquid crystals: Definition, types (Thermotropic & lyotropic liquid crystals). Properties of liquid crystals: Electric effect & Optic effect. Applications of liquid crystals in Liquid crystal display (LCD). Light emitting diode (LED): Definition, working principle. Types of LED: Organic light emitting diodes (OLED's), Quantum Light emitting diodes (QLED's) and Light emitting electrochemical cells (LEEC's).

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Suba Ramesh and S. Vairam | Engineering Chemistry - A text book of Chemistry for Engineers. Wiley India 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Sankar P. Dey, Nayim Sepay | A Textbook of Green Chemistry, First Edition, Techno World Publisher, 2021 |
| 2 | S.K. Dhawan and Hema Bhandari | Corrosion Preventive Materials and Corrosion Testing, CRC Press, 2020 **ISBN-13:** 978-1351588430 |
| 3 | Kavita Shakya Chahal & Twinkle Solanki | Green Chemistry & E-Waste Management IGI Global (2022**), ISBN-13:** 978-1799898511 |
| 4 | Poushali Das, Sayan Ganguly | Quantum Dots and Polymer Nanocomposites: Synthesis, Chemistry and Applications: CRC Press, 2022 |
| 5 | Sabar D. Hutagalung | Materials Science and Technology, InTech Publishers, 2012 |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Explore the use of electrode materials for the construction of batteries and green chemistry for environmental sustainability.

**CO2 :** Apply the knowledge of sensors in chemical analysis, also to apply the electrochemical theory of corrosion and its control.

**CO3 :** Apply the concepts of green materials and its application in forensic science and E - Waste management.

**CO4 :** Describe the concepts of quantum materials, polymers and applications in the development of solar and fuel cells.

**CO5 :** Explain the importance of functional materials in the development of memory and display systems.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | √ | | | | | | | | | | | | |
| | CO4 | √ | | | | | | | | | | | | |
| | CO5 | √ | | | | | | | | | | | | |

# PRACTICAL MODULE

**Course Objectives :** This course will enable students :

- The use of pH sensor for the determination of $pK_a$ of given soft drinks.
- The construction and use of electrochemical cell as sensor for the determination of emf /concentration of redox species.
- The usage of optical sensor (colorimeter) for the estimation of metals in various matrices.
- The use of conductivity meter for the determination of conductance in electrolytic solutions.
- The application of volumetry in the analysis of water quality parameters.

| | |
|---|---|
| **A – Instrumental Methods of Analysis:** | |
| A1 | Determination of pKa of given sample of soft drink using pH sensor and its graphical interpretation using origin software. |
| A2 | Estimation of iron present in stainless steel solution using electrochemical sensor and its graphical interpretation using origin software. |
| A3 | Optical sensor for copper determination from E - waste sample (printed circuit board) And its graphical interpretation using origin software. |
| A4 | Conductometric sensor for the estimation of HCl and its graphical interpretation using origin software. |
| **B – Volumetric Methods of Analysis:** | |
| B1 | Determination of total hardness of water for drinking purpose. |
| B2 | Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. |
| B3 | Redox titration - Determination of iron in the given TMT bars by external indicator method. |
| B4 | Determination of alkalinity of given water sample. |
| **C – Demonstration Experiments (Any two):** | |
| C1 | Synthesis of nano ZnO by combustion method. |
| C2 | Green synthesis of conductive inks for flexible electronic applications. |
| C3 | Evaluation of acid content in beverages using pH sensors. |
| C4 | Detection of sugar in a blood sample using Fehling's solution. |
| **D – Open Ended Experiments (Any two):** | |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Arthur I. Vogel | Quantitative Inorganic Analysis and Elementary Instrumental Analysis: ELBS, Longmann Group, 5th Edition, 1989 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Determine the electrode potential of newly constructed electrodes; calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples.

**CO2 :** Estimate the amount of metal(s) in effluents by potentiometer.

**CO3 :** Determine the metals/pollutants in water and alloys using colorimeter.

**CO4 :** Measure the conductance of solutions/electrolytes which in turn can be used for the determination of its characteristics.

**CO5 :** Use the knowledge of volumetric analysis for estimation of metals and water samples.

### Mapping of Course Outcomes with Program outcomes

1. Ability to apply knowledge of science to the engineering problems.
2. Ability to analyze the problems using the principles of science.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | | √ | | | | | | | | | | | |
| | CO4 | | √ | | | | | | | | | | | |
| | CO5 | | √ | | | | | | | | | | | |

# Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems (ME Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | ACM |

**Course Objectives :** This course will enable students :

- Master the knowledge of lubricants, coolants, and application of instrumentation techniques for the determination of different types of analyses present in effluents.
- Gain the knowledge on the battery concept, construction and working of batteries, fuel cells, nanomaterials preparation, graphene and applications in energy storage.
- Master the knowledge on the importance of polymers, preparation of engineering polymeric materials, carbon fiber and 3-D printing materials.
- Learn the corrosion mechanism, corrosion control and coating technologies.
- Learn the basic concepts of artificial fuels, biofuels and green fuels used for combustion engines.

## UNIT - I

**SENSOR TECHNOLOGIES AND ADVANCED FLUIDS** **08 Hrs.**

**Sensing Technologies:** Introduction, Optical sensors: Colorimetry - Principle and statement of Beer-Lambert's law, Numerical problems. Electrochemical sensors: Potentiometry - Principle, instrumentation and application in the estimation of iron in steel industry effluents (ex. redox titration of FAS against $K_2Cr_2O_7$). pH sensor- principle and its application in the estimation of pKa of acid electrolyte. Conductometric sensors: Principle, instrumentation and applications of conductometric titrations in industrial effluents - strong acid against strong base, mixture of acids (strong acid + weak acid) against a strong base.

**Lubricants:** Introduction, classification, properties and industrial applications of lubricants. Lubricant testing - experimental determination of viscosity.

**Industrial coolants:** Introduction, types - water and oil based coolants, properties and industrial applications.

**Industrial effluents:** Introduction, determination of chemical oxygen demand (COD) and numerical problems.

## UNIT - II

**ADVANCED ENERGY AND NANOMATERIALS 08 Hrs.**

**Energy storage devices:** Introduction, classification of batteries, characteristics (capacity, power density, cell balancing and cycle life). Construction, working and applications of Lead acid battery and Lithium-ion battery.

**Fuel cells and renewable energy:** Introduction, construction and working of solid oxide fuel cells (SOFCs) for Auxiliary Power Units (APUs) applications. Difference between fuel cell and battery, Photovoltaic cells-construction, working, advantages, limitations and applications.

**Nanochemistry:** Introduction, size dependent properties of nanomaterials (surface area, catalytic and electrical), types of nanomaterials - based on composition (carbon based, metal based, composite and dendrimers). Production of nanomaterials – top down and bottom up approaches. Synthesis of nanometal oxides-semiconducting nano ZnO by solution combustion method and nano $TiO_2$ by hydrothermal method.

**Graphene:** Synthesis by chemical vapor deposition (CVD) method, properties and engineering applications. Role of carbon nanotubes (CNT) in energy devices.

## UNIT - III

**ADVANCED MATERAILS FOR ENGINEERING PPLICATIONS 08 Hrs.**

**Engineering Polymers:** Introduction, classification - based on occurrence, structure and effect of heat on polymer. Number average and weight average molecular weight - definition and numerical problems. Synthesis, properties and applications of PVC and PMMA. Glass transition temperature-Definition and factors affecting Tg (flexibility, molecular weight, inter molecular force).

**Polymer composites:** Introduction, fiber-reinforced polymer (FRPS) Kevlar-synthesis, properties and industrial applications.

**Carbon fiber:** Preparation from poly acrylonitrile (PAN), properties and applications.

**3-D printing materials:** Introduction, synthesis, properties and applications of poly lactic acid (PLA) resin.

## UNIT - IV

**CORROSION SCIENCE AND COATING TECHNOLOGY 08 Hrs.**

**Corrosion Chemistry:** Introduction, electrochemical theory of corrosion, types of corrosion- differential metal and differential aeration corrosion (waterline

and pitting corrosion). Corrosion Penetration Rate (CPR)- numerical problems. Corrosion control: Metal coatings – galvanization. Surface conversion coating: Inorganic coatings- anodization of Aluminium, Cathodic protection - Impressed voltage method and Sacrificial anode method.

**Coating Technology:** Introduction, technological importance, Electroplating of chromium (hard and decorative). Electroless plating - electroless plating of nickel. Difference between electroplating and electroless plating.

## UNIT - V

**ADVANCED SYNTHETIC AND GREEN FUELS** **08 Hrs.**

**Fuels:** Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV. Knocking in internal combustion engines, knocking mechanism and anti-knocking agnets, Methyl tertiary butyl ether (PTBE) and Ethyl tertiary bytyl ether (ETBE), importance of octane and cetane rating of fuel.

**Bio fuels:** Introduction, power alcohol-advantages and disadvantages, synthesis of biodiesel by Trans-esterification method, advantages and its applications.

**Green Fuels:** Introduction, examples, Water splitting-Definition, Production of green hydrogen by photocatalytic water splitting ($TiO_2$) method and its advantages.

**Hydrogen storage:** Introduction, advantages, limitations of metal hydride and ammonia as chemical hydrogen carriers.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Suba Ramesh and S. Vairam | Engineering Chemistry - A text book of Chemistry for Engineers. Wiley India 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | D. A Skoog, F. J. Holler and Stanley R. Crouch | Instrumental Analysis, Cengage Learning India Pvt. Ltd., 2010 |
| 2 | Colin Tong | Introduction to Materials for Advanced Energy Systems, Springer Nature Publication, 2019 |
| 3 | Charles C Hermant | Polymer Chemistry, Oxford Book Company, 2018 |
| 4 | Pietro Pedeferri | Corrosion Science and Engineering, Springer Nature Publication, 2018 |

| | | |
|---|---|---|
| 5 | A. Pratap Singh, DhananjayKumar, Avinash Kumar Agarwal | Alternative Fuels and Advanced Combustion Techniques as Sustainable Solutions for Internal Combustion Engines, Springer Nature Publication, 2021 |

**Course Outcomes :**

Upon completion of this course, students will be able to :

**CO1 :** Extend the concept of lubricants and coolants to combustion engine, application of sensor technology to the detection of trance concentration and also the conductivity of the solution using conductometric sensor.

**CO2 :** Apply the knowledge of electrochemistry for the construction of batteries, fuel cells and also preparation of nanomaterials by different methods.

**CO3 :** Apply the knowledge on the preparation of advanced polymers, carbon fiber, 3-D printing materials.

**CO4 :** Apply the electrochemical theory of corrosion of metals/alloys, corrosion control methods and coating technology.

**CO5 :** Explain the importance of fuel includes synthetic fuels, bio fuels and green fuels

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | √ | | | | | | | | | | | | |
| | CO4 | √ | | | | | | | | | | | | |
| | CO5 | √ | | | | | | | | | | | | |

# PRACTICAL MODULE

**Course Objectives :** This course will enable students :

- The use of pH sensor for the determination of $pK_a$ of given soft drinks.
- The construction and use of electrochemical cell as sensor for the determination of emf /concentration of redox species.
- The usage of optical sensor (colorimeter) for the estimation of metals in various matrices.
- The use of conductivity meter for the determination of conductance in electrolytic solutions.
- The application of volumetry in the analysis of water quality parameters.

| | |
|---|---|
| **A – Instrumental Methods of Analysis:** | |
| A1 | Determination of pKa of given sample of soft drink using pH sensor and its graphical interpretation using origin software. |
| A2 | Estimation of iron present in stainless steel solution using electrochemical sensor and its graphical interpretation using origin software. |
| A3 | Optical sensor for copper determination from e - waste sample (printed circuit board) and its graphical interpretation using origin software. |
| A4 | Estimation of HCl using standard NaOH conductometrically and its graphical interpretation using origin software. |
| **B – Volumetric Methods of Analysis:** | |
| B1 | Determination of total hardness of water for drinking purpose. |
| B2 | Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. |
| B3 | Redox titration - Determination of iron in the given TMT bars by external indicator method. |
| B4 | Determination of alkalinity of given water sample. |
| **C – Demonstration Experiments (Any two):** | |
| C1 | Synthesis of semiconducting nano ZnO by combustion method. |
| C2 | Green synthesis of conductive inks for flexible electronic applications. |
| C3 | Doping of electronic material (ZnO) with dopants (Cu/Ni) to increase the conductivity of material. |
| C4 | Synthesis of polyaniline as a conducting polymer. |
| **D – Open Ended Experiments (Any two):** | |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Arthur I. Vogel | Quantitative Inorganic Analysis and Elementary Instrumental Analysis: ELBS, Longmann Group, 5th Edition, 1989 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Determine the electrode potential of newly constructed electrodes; calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples.

**CO2 :** Estimate the amount of metal(s) in effluents by potentiometer.

**CO3 :** Determine the metals/pollutants in water and alloys using colorimeter.

**CO4 :** Measure the conductance of solutions/electrolytes which in turn can be used for the determination of its characteristics.

**CO5 :** Use the knowledge of volumetric analysis for estimation of metals and water samples.

### Mapping of Course Outcomes with Program outcomes

1. Ability to apply knowledge of science to the engineering problems.
2. Ability to analyze the problems using the principles of science.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | | √ | | | | | | | | | | | |
| | CO4 | | √ | | | | | | | | | | | |
| | CO5 | | √ | | | | | | | | | | | |

# Applied Chemistry for Emerging Electronics and Futuristic Devices (EEE & ECE Stream)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | ACE |

**Course Objectives :** This course will enable students :

- Learn the basic concepts of electrochemistry, electrode potentials that are essential to determine the battery voltage and the working principle, applications of analytical instruments.
- Learn the corrosion mechanism, corrosion control techniques and problems associated with E-waste.
- Explain the concepts of batteries, semiconductors and photovoltaic cells.
- Master the knowledge of synthesis, applications of nanomaterials and quantum dots for smart materials.
- Convey the necessity of advanced polymeric materials as conducting polymers, composites and stretchable devices.

## UNIT - I

### ELECTRODE SYSTEM AND ELECTROCHEMICAL SENSORS 08 Hrs.

**Electrochemical cells:** Classification - galvanic cells and electrolytic cells with examples. Construction and working of a galvanic cell (e.g. Daniel cell). Single electrode potential, standard electrode potential and E.M.F of a cell – definition and Nernst equation (basic overview). Concentration cells – definition, construction, working and equation for E.M.F of a concentration cell. Numerical problems on Nernst equation and concentration cell. Electrodes: Reference electrodes – construction, working and applications of Calomel electrode. Ion-selective electrodes – construction, working and application of glass electrode for the determination of pH of a solution.

**Sensing Techniques:** Optical sensors: Colorimetry - principle, instrumentation and application in the estimation of copper in PCB's. Numerical problems. Electrochemical sensors: Potentiometry- Principle, instrumentation, and application in redox titration (e.g. FAS against $K_2Cr_2O_7$).

**Conductometric sensors:** Principle, instrumentation and application in titrations of strong acid against a strong base and mixture of acids (strong acid + weak acid) against a strong base.

## UNIT - II

**CORROSION SCIENCE AND E-WASTE MANAGEMENT 08 Hrs.**

**Corrosion Chemistry:** Metallic corrosion, electrochemical theory of corrosion, types of corrosion- differential metal and differential aeration corrosion (waterline and pitting corrosion). Corrosion penetration rate (CPR)- numerical problems. Corrosion control- Metal coatings- galvanization, Inorganic coatings- anodization, Cathodic protection - Impressed voltage method and Sacrificial anode method.

**Metal finishing:** Introduction, difference between Electroplating and Electroless plating, Electroplating of chromium (hard and decorative). Electroless plating of copper on PCBs.

**E-waste Management:** Introduction, sources, effects of E-waste on environment and human health, methods of disposal, advantages of recycling. Extraction of gold from E-waste by hydrometallurgy.

## UNIT - III

**MATERIALS FOR ENERGY DEVICES 08 Hrs.**

**Semiconductors:** Introduction, n-type and p-type semiconductor materials, difference between organic and inorganic semiconductors, organic photovoltaics – Poly (3-hexylthiophene) (P3HT) as a donor and Phenyl-C61-butyric acid methyl ester (PCBM) as an acceptor, construction, working and applications.

**Energy Storage Devices:** Introduction, classification of batteries-primary, secondary and reserve battery, characteristics (capacity, power density, cell balancing & cycle life), construction and working of lithium-ion battery advantages in EV applications, construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices.

**Energy Conversion Devices:** Introduction, construction, working principle, advantages and applications of photovoltaic cell (PV cell), Introduction to MEMS-Based Energy Harvesters, working principle and applications.

## UNIT - IV

**NANO AND QUANTUM DOT MATERIALS 08 Hrs.**

**Nanomaterials:** Introduction, size dependent properties of nanomaterials (surface area, catalytic and electrical), types of nano materials – based on

materials (carbon based, metal based, composites and dendrimers). Production of nanomaterials – definition of top down and bottom up process. Synthesis of nanometal oxides – semiconducting nano ZnO by solution-combustion method and nano $TiO_2$ by hydrothermal method. Carbon nanotubes – definition and synthesis by arc discharge method.

**Quantum Dot Materials:** Introduction to quantum dots, Types-inorganic and organic quantum dots. Optical and electronic properties of quantum dots (QDs).

**Inorganic Quantum Dot Materials (IQDMs):** Introduction, synthesis and properties of silicon based QDs by Sol-Gel method, CdSe quantum dots by hot injection method and applications in optoelectronic devices, quantum dot-based copper conductive ink by wet chemical reduction method, properties and applications.

**Organic Quantum Dot Materials (OQDMs):** Introduction, synthesis and properties of chitosan-carbon quantum dots hydrogel applications in next-generation flexible and wearable electronics, synthesis and properties of graphene quantum dots using citric acid method its applications in emerging electronics.

## UNIT - V

### FUNCTIONAL POLYMERS AND HYBRID COMPOSITES IN FLEXIBLE ELECTRONICS 08 Hrs.

**Polymers:** Introduction, classification - based on occurrence, structure and effect of heat on polymer. Number average and weight average molecular weight - definition and numerical problems. Conducting polymers - mechanism of conduction in polyacetylene (oxidative doping). Synthesis and applications of Polyaniline.

**Polymer Composites:** Introduction, synthesis and properties of epoxy resin-$Fe_3O_4$ composite for sensors applications, synthesis of Kevlar Fiber Reinforced Polymer (KFRP)-properties and smart electronic devices applications.

**Stretchable and Wearable Microelectronics:** Introduction, basic principle and working of Lithography for micro-patterned copper deposition, synthesis, properties and applications of PDMS (Polydimethylsiloxane) in e-skin (electronic skin) and RFID (Radio Frequency Identification), synthesis and properties of Polyvinylidene Fluoride (PVDF) applications in E-nose devices.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Suba Ramesh and S. Vairam | Engineering Chemistry - A text book of Chemistry for Engineers. Wiley India 2020 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Subhendu Bhandari and Arti Rushi | Materials for Chemical Sensors, CRC Press, 2023 |
| 2 | S.K. Dhawan and Hema Bhandari | Corrosion Preventive Materials and Corrosion Testing, CRC Press, 2020 |
| 3 | Anurag Gaur, A.L. Sharma, Anil Arya | Supercapacitors, batteries and hydroelectric Cells, CRC Press, 2021 |
| 4 | B. Viswanathan | Structure and properties of solid state materials, Narosa Publications, 2009 |
| 5 | Sabar D. Hutagalung | Materials Science and Technology, InTech Publishers, 2012 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Explain the electrode potential of newly constructed electrodes and evaluate the voltage of electrochemical cells; colorimetric, potentiometric and conductometric sensors in chemical analysis.

**CO2 :** Apply the concept of electrochemical theory of corrosion of metals, corrosion control methods and E-wastes disposal.

**CO3 :** Apply the knowledge of semiconductors, batteries and photovoltaic cells as energy devices.

**CO4 :** Describe the ideas of nanomaterials and applications of quantum dots for smart materials.

**CO5 :** Apply the concepts of different polymers as conducting polymers, composites and stretchable devices.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | √ | | | | | | | | | | | | |
| | CO4 | √ | | | | | | | | | | | | |
| | CO5 | √ | | | | | | | | | | | | |

# PRACTICAL MODULE

**Course Objectives :** This course will enable students :

- The use of pH sensor for the determination of $pK_a$ of given soft drinks.
- The construction and use of electrochemical cell as sensor for the determination of emf /concentration of redox species.
- The usage of optical sensor (colorimeter) for the estimation of metals in various matrices.
- The use of conductivity meter for the determination of conductance in electrolytic solutions.
- The application of volumetry in the analysis of water quality parameters.

| | |
|---|---|
| **A – Instrumental Methods of Analysis:** | |
| A1 | Determination of pKa of given sample of soft drink using pH sensor and its graphical interpretation using origin software. |
| A2 | Estimation of iron present in stainless steel solution using electrochemical sensor and its graphical interpretation using origin software. |
| A3 | Optical sensor for copper determination from e - waste sample (printed circuit board) and its graphical interpretation using origin software. |
| A4 | Estimation of HCl using standard NaOH conductometrically and its graphical interpretation using origin software. |
| **B – Volumetric Methods of Analysis:** | |
| B1 | Determination of total hardness of water for drinking purpose. |
| B2 | Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. |
| B3 | Redox titration - Determination of iron in the given TMT bars by external indicator method. |
| B4 | Determination of alkalinity of given water sample. |
| **C – Demonstration Experiments (Any two):** | |
| C1 | Synthesis of semiconducting nano ZnO by combustion method. |
| C2 | Green synthesis of conductive inks for flexible electronic applications. |
| C3 | Doping of electronic material (ZnO) with dopants (Cu/Ni) to increase the conductivity of material. |
| C4 | Synthesis of polyaniline as a conducting polymer. |
| **D – Open Ended Experiments (Any two):** | |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Arthur I. Vogel | Quantitative Inorganic Analysis and Elementary Instrumental Analysis: ELBS, Longmann Group, 5th Edition, 1989 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Determine the electrode potential of newly constructed electrodes; calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples.

**CO2 :** Estimate the amount of metal(s) in effluents by potentiometer.

**CO3 :** Determine the metals/pollutants in water and alloys using colorimeter.

**CO4 :** Measure the conductance of solutions/electrolytes which in turn can be used for the determination of its characteristics.

**CO5 :** Use the knowledge of volumetric analysis for estimation of metals and water samples.

### Mapping of Course Outcomes with Program outcomes

1. Ability to apply knowledge of science to the engineering problems.
2. Ability to analyze the problems using the principles of science.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | √ | | | | | | | | | | | |
| | CO2 | | √ | | | | | | | | | | | |
| | CO3 | | √ | | | | | | | | | | | |
| | CO4 | | √ | | | | | | | | | | | |
| | CO5 | | √ | | | | | | | | | | | |

# Building Materials

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 42 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC8 |

**Course Objectives :** This course will enable students :

- Understand the composition, manufacturing processes, properties, classifications, and applications of convention al building materials such as bricks, stones, aggregates, mortar, timber, and cement
- Acquire knowledge of miscellaneous building materials including glass, plastics, paints, varnishes, gypsum, metals, waterproofing materials, sealants, composites, bitumen, and asphalt.
- Evaluate the quality and performance of building materials through standard tests and selection criteria for construction projects.
- Develop awareness of sustainable, eco-friendly and innovative construction materials and their role in modern construction practices.

## UNIT - I

**BASIC BUILDING MATERIALS - I** **09 Hrs.**

Bricks, Stones, Aggregates, Mortar • Bricks: Composition, qualities, classification, manufacturing (traditional and modern methods), clamp vs kiln burning, Wire-cut Bricks • Stones: Properties, classification, quarrying, and types of stone masonry (random rubble, coursed rubble, ashlar). •

## UNIT - II

**TIMBER PRODUCTS AND CEMENT** **09 Hrs.**

Timber: Structure, defects, seasoning, preservation, fire-resisting treatment • Wood products: Veneers, plywood, fibreboard, particleboard, blockboard, laminated wood. • Cement, Types of cement, Tests on cement •

## UNIT - III

**MISCELLANEOUS MATERIALS - I** **08 Hrs.**

Glass (types, properties, uses), plastics (types, applications), paints and varnishes, distempers, adhesives, gypsum • Aluminium • Aggregates: Classification, properties (mechanical, physical, thermal), manufactured sand, importance of grading, bulking of sand, quality of water for construction •

## UNIT - IV

**MISCELLANEOUS MATERIALS - II** **08 Hrs.**

Mortar : Types (lime mortar, cement mortar, mud mortar), properties, defects, and applications • Metals: Properties and uses of steel (mild, high-carbon, high-strength deformed steel), aluminum, copper• Waterproofing materials and sealants • Composite materials • Bitumen and asphalt: Properties, classification, uses in building & road construction •

## UNIT - V

**SUSTAINABLE AND INNOVATIVE MATERIALS** **08 Hrs.**

Sustainable materials: Locally available, recycled, industrial waste, alternative materials • Innovative materials : Stabilized soil blocks, hollow & solid concrete blocks, AAC blocks, ferrocement panels, marble slurry bricks, innovative tiles, porcelain, earthenware, glazing •

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | S.K. Duggal | Building Materials, New Age International Publishers, 5th Edition, 2017 |
| 2 | S.C. Rangwala | Engineering Materials, Charotar Publishing House, 42nd Edition, 2016 |
| 3 | S.S. Bhavikatti | Building Materials, (2012), First Edition, Vikas Publishing House, ISBN-13 978-9325960442 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Haimei Zhang | Building Materials in Civil Engineering, Woodhead Publishing, 1st Edition, 2011 |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Explain the composition, manufacturing methods, classification, properties, and applications of bricks, stones, aggregates, and mortars used in construction

**CO2 :** Describe the structure, properties, defects, preservation methods, and engineering applications of timber, wood products, and cement including standard quality assessment tests.

**CO3 :** Identify and compare the properties, advantages, limitations, and uses of miscellaneous building materials such as glass, plastics, paints, varnishes, gypsum, aluminum, aggregates, and construction water

**CO4 :** Evaluate the suitability of mortars, metals, waterproofing materials, sealants, composites, bitumen, and asphalt for specific building and infrastructure applications

**CO5 :** Assess sustainable and innovative building materials, including recycled and alternative materials, AAC blocks, stabilized soil blocks, ferrocement products, and other emerging construction materials, with emphasis on sustainability and performance

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | 3 | 2 | | | | | | | | | | | | |
| | **CO2** | 3 | 2 | | | | | | | | | | | | |
| | **CO3** | 3 | 3 | | | | | | | | | | | | |
| | **CO4** | 3 | 3 | | | | | | | | | | | | |
| | **CO5** | 2 | | | | | | | | | | | | | |

# Elements of Mechanical Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC2 |

**Course Objectives :** This course will enable students :

- Acquiring a basic understanding about steam and Steam, Gas and Water Turbines.
- Students will be introduced to fundamentals of IC engines & refrigeration concepts.
- Students will be exposed to power transmission.
- Acquire a basic knowledge about conventional and advanced manufacturing processes.
- Acquiring a basic insight into future mobility such as Mechatronics, CNC and Additive Manufacturing

## UNIT - I

**FORMATION OF STEAM, TURBINES** **08 Hrs.**

**Formation of steam:** Formation of steam, Types of steam, Steam properties - specific volume, enthalpy and internal energy, Simple numerical problems.

**Steam turbines** –Classification, Principle of operation of De Laval impulse and Parsan's reaction steam turbine.

**Gas turbines-** Classification, Principle of operation of open cycle gas turbine & closed cycle gas turbine.

**Water turbines** - Classification, principle of operation of Pelton wheel.

## UNIT - II

**I C ENGINES & REFRIGERATION** **08 Hrs.**

**Internal Combustion Engines:** Construction of IC engine parts, 4 stroke Diesel engine. Numerical problems on IP, BP, FP, Mechanical & Thermal efficiency**. (PO2)**

**Refrigeration:** Principle of refrigeration, Unit of refrigeration, working principle of Vapour compression refrigeration and vapour absorption refrigeration, List of commonly used refrigerants **(PO1)**

## UNIT - III

**POWER TRANSMISSION** **08 Hrs.**

**Belt drives:** Types of belt drives, stepped cone pulley, Velocity ratio in belt drives, Slip and Creep in belts drives.

**Gear Drives:** Types of gears- Spur, Helical, Spiral, Bevel, Worm gears, Rack and Pinion, and Velocity ratio in Gears. Spur Gear Nomenclature.

**Gear Trains:** Types of Gear trains, Working of Simple gear train, Compound gear train, Simple numerical problems on gear trains.

## UNIT - IV

**MACHINE TOOLS** **08 Hrs.**

**Lathe:** Principle of Working, Construction of Centre Lathe, classification of lathe, Specification of lathe, Lathe operations – Turning, Facing, Knurling, Thread cutting, Taper Turning by Tailstock offset Method. **(PO1)**

**Drilling:** Principle of working, classification of drilling machine, Construction and Working of Bench drilling machine and its operations, Drilling, Boring, Reaming, Tapping, Countersinking, Counter-boring and Spot facing. **(PO1)**

**Milling:** Principle of working, classification of milling machines, Construction and working of horizontal milling machine. Milling operations - Slot milling, Form milling, Angular milling, Gang milling **(PO1)**

## UNIT - V

**JOINING PROCESS, MECHATRONICS, CNC AND ADDITIVE MANUFACTURING** **08 Hrs.**

**Joining Processes:** Soldering, Brazing, and welding definitions only, working of Oxy-Acetylene Gas welding and Arc Welding.

**Introduction to Mechatronics:** Systems of Mechatronics, advantages and disadvantages, Measurement Systems and Control Systems - Open loop control system and close loop control system (with simple block diagrams).

**Introduction to Additive Manufacturing:** classification and any one concept of Additive Manufacturing (3D printing by Stereo lithography process).

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K R Gopala Krishna | Elements of Mechanical Engineering, Subhash Publications, 2008 |
| 2 | Hazra Choudhry and Nirzar Roy | Elements of Workshop Technology (Vol. 1 and 2), Media Promoters and Publishers Pvt. Ltd., 2010 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Jonathan Wickert and Kemper Lewis | An Introduction to Mechanical Engineering, Third Edition 2012 |
| 2 | P.N. Rao | Manufacturing Technology - Foundry, Forming and Welding, Tata McGraw Hill 3rdEd., 2003 |
| 3 | P.N. Rao | CAD/CAM principles and applications, , Tata McGraw Hill 2nd Edition |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Explain the basic principles of formation of steam and its application such as Steam Turbine, Gas Turbine and water turbines.

**CO2 :** Describe the performance parameters of IC engines and working principles of VAR and VCR refrigeration system.

**CO3 :** Describe the working of various mechanical power transmission for engineering applications.

**CO4 :** Describe different conventional and advanced machining tools such as Lathe, drilling and milling machines.

**CO5 :** Enumerate various aspects of future mobility, such as Mechatronics, CNC, and 3D printing technology.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 2 | | | | | | | | | | | | |
| | **CO2** | 2 | | | | | | | | | | | | |
| | **CO3** | 2 | | | | | | | | | | | | |
| | **CO4** | 2 | | | | | | | | | | | | |
| | **CO5** | 2 | | | | | | | | | | | | |

# Basics of Electrical Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC3 |

**Course Objectives :** This course will enable students :

- To introduce fundamental concepts of electric circuits and electromagnetism.
- Voltage-current relation & power equations in R L C circuits and analysis of series and parallel A.C. circuits.
- Generation of three phase voltages, relation between phase & line values in star and delta connected circuits.
- Construction and principle of operation of D.C. motor, types of motors, speed control of separately excited D.C. motor.
- To study the domestic wiring and electrical safety practices.

## UNIT - I

**DC CIRCUITS** **08 Hrs.**

**DC circuits:** Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. Numericals.

**Electromagnetism:** Faraday's Laws of Electromagnetic Induction, Lenz's Law, Fleming's rules, statically and dynamically induced EMF; concepts of self and mutual inductance. Coefficient of Coupling. Energy stored in magnetic field. Numericals.

## UNIT - II

**SINGLE-PHASE AC CIRCUITS** **08 Hrs.**

**Single-phase AC circuits:** Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities. Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor. Series, Parallel and Series-Parallel circuits. Numericals.

## UNIT - III

**THREE-PHASE AC CIRCUITS** **08 Hrs.**

**Three-phase AC circuits:** Necessity and advantage of 3-phase system. Generation of 3-phase power. Definition of phase sequence. Balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Power in balanced 3-phase circuits.

**Transformers:** Necessity of transformer, principle of operation, Types and construction of single- phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency. Rating, cost, size and applications. Numerical.

## UNIT - IV

**DC MACHINES** **08 Hrs.**

**DC Generator:** Principle of operation, constructional details, induced emf expression, types of Generators. Relation between induced emf and terminal voltage. Numericals.

**DC Motor:** Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and speed control (armature & field) of DC motors(series & shunt only). Applications of DC motors. Numericals.

## UNIT - V

**THREE-PHASE INDUCTION MOTORS** **08 Hrs.**

**Three-phase induction Motors:** Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance Rating, cost, size and applications. Numerical. Domestic Wiring: Requirements, Types of wiring: conduit wiring and casing & capping. Two way and three-way control of lamp load.

**Safety measures:** Domestic electric circuit including protective devices, working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Electric Shock, Earthing, types (Plate and pipe earthing), Safety Precautions to avoid shock

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | D C Kulshreshtha | Basic Electrical Engineering, Tata McGraw Hill, 1st Ed., 2019, ISBN-13: 9789353167219 |
| 2 | D. P. Kothari and I. J. Nagrath | Basic Electrical Engineering, Tata McGraw Hill, 4th Ed., 2019, **ISBN-13:** 9789353165727 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | V. K. Mehta, Rohit Mehta | Principles of Electrical Engineering & Electronics, S. Chand and Company Publications, 2nd Ed., 2015, **ISBN-13:** 9788121927291 |
| 2 | E. Hughes | Electrical Technology, Pearson, 12th Ed., 2016. **ISBN-13:** 978-1-292-09304-8 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Apply the concepts of basic laws to solve electric circuits and Faraday's laws to solve electromagnetic circuits.

**CO2 :** Analyze R, L, C, R-L, R-C and R-L-C Series and Parallel AC circuits.

**CO3 :** Determine the relation between phase and line values of voltage and current in three phase circuits. Illustrate Construction and operation of various Electrical Machines.

**CO4 :** Analyze the working principle of D.C. machine and speed control of separately excited D.C. motor.

**CO5 :** Illustrate working of A.C. Machines and concepts of domestic wiring, protective devices, solar photo voltaic system and safety measures.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 2 | | | 1 | | 2 | | | | 1 | | |
| | **CO2** | 3 | 2 | | | 1 | | | | | | 1 | | |
| | **CO3** | 3 | 2 | | | | | 2 | | | | 1 | | |
| | **CO4** | 3 | 2 | | | | | | | | | 1 | | |
| | **CO5** | 3 | 2 | | | | | 3 | | | | 1 | | |

# Fundamentals of Electronics & Communication Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC4 |

**Course Objectives :** This course will enable students :

- Analyze & design different stages of DC power supply
- Get knowledge of the working and application of transistors
- Build the analog computational circuits using OPAMP and generate AC signal of required frequency using Oscillator circuits
- Understand different analog modulation techniques
- Understand basics of digital electronics

## UNIT - I

**SEMICONDUCTOR DIODE AND ITS APPLICATIONS** **08 Hrs.**

Review of PN–junction, diode equation, VI characteristics, effect of temperature, diode approximation, DC load line analysis, Zener diode: Working, VI characteristics. Basic building blocks of a regulated DC power supply: Half wave rectifier, Full wave rectifier, Capacitor filter (qualitative analysis). Zener regulator (includes numericals on diode equation, rectifier, filter and Zener regulator). Clipping circuits (Shunt single ended) and clamping circuits.

## UNIT - II

**TRANSISTORS AND THEIR APPLICATIONS** **08 Hrs.**

Bipolar junction transistor, CB and CE configuration and characteristics, BJT as switch and amplifier, Fixed bias and voltage divider bias, DC load line and operating point, Single stage RC coupled amplifier and its frequency response,

**Field Effect Transistor:** Junction field effect transistor (N-channel), JFET characteristics, Enhancement MOSFETs (N-channel): Classification, Construction and drain characteristics

**Case study:** MOSFET as a switch

## UNIT - III

**OPERATIONAL AMPLIFIER AND OSCILLATORS** **08 Hrs.**

Block diagram of an Operational amplifier, Schematic symbol, differential amplifier, Characteristics of an ideal operational amplifier,

**Op-Amp parameters:** gain, input resistance, output resistance, CMRR, slew rate, bandwidth, input offset voltage, input bias current and input offset current. Equivalent circuit of Op-Amp, concept of virtual ground,

**Op-amp applications:** Inverting and non-inverting amplifier, Voltage follower, Adder, Subtractor, Integrator and differentiator.

Concept of positive feedback, Barkhausen criteria for oscillations, RC phase-shift oscillator and Wein bridge oscillator.

## UNIT - IV

**COMMUNICATION SYSTEM** **08 Hrs.**

Block diagram of communication system, communication channels and their characteristics: wire line, fiber optic, wireless electromagnetic channels. Need for modulation,

**Analog Modulation:** AM, FM, PM (Definition, waveforms, expressions and comparisons excluding derivations and spectral diagrams)

**Applications:** AM radio broadcasting, super heterodyne FM receiver, mobile wireless telephone systems

Case study of converting analog signal to digital signal using PCM**.**

## UNIT - V

**FUNDAMENTALS OF DIGITAL SYSTEMS & BINARY NUMBERS** **08 Hrs.**

Digital Systems, introduction to number systems (Binary, Octal, decimal, Hexadecimal). Number base conversion: (binary to decimal, hexa decimal and vice versa), Binary addition, binary subtraction using 1's and 2's complement method. Review of logic gates, Universal gates. Boolean Algebra: De Morgan's theorems, Simplification of Boolean expressions using Boolean laws and K-map, realization of Boolean expressions using basic gates and NAND gates, Half adder, Full adder and Parallel adder.

Case study with four bit adder simulation.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | David A Bell | Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025 |
| 2 | Ramakanth A Gayakwad | Op-amps and Linear Integrated Circuits, Pearson Education, 4th Edition, 2015 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | John G. Proakis, Masoud Saleh | Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014 |
| 2 | D.P Kothari and I J Nagrath | Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018 |
| 3 | M. Morris Mano and Michael D.Ciletti | Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Analyze PN junction diodes & different stages of DC power supply.

**CO2 :** Analyze transistor characteristics and its application.

**CO3 :** Design OPAMP application circuits.

**CO4 :** Analyze the fundamental concepts of communication system.

**CO5 :** Apply Boolean laws to simplify logic expressions and circuits.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | 3 | 2 | | | 1 | | | | | | | 1 | |
| | CO2 | 3 | 2 | | | 1 | | | | | | | 1 | |
| | CO3 | 3 | 2 | | | 1 | | | | | | | 1 | |
| | CO4 | 3 | 1 | | | 1 | | | | | | | 1 | |
| | CO5 | 3 | 2 | | | 1 | | | | | | | 1 | |

# Structured Programming in C

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC5 |

**Course Objectives :** This course will enable students :

- Elucidate the basic architecture and functionalities of a computer.
- Apply programming constructs of C language to solve the real-world problems.
- Explore user-defined data structures like arrays, structures, and pointers in implementing solutions to problems.
- Design and Develop Solutions to problems using structured programming constructs such as functions and procedures.

## UNIT - I

**INTRODUCTION TO C** **08 Hrs.**

Introduction to computers, input and output devices, designing efficient programs. Introduction to C, Structure of C program, writing the first C program, Files used in a C program, Compiling and executing C programs, Using Comments, C Token, Character set in C, Keywords, Identifiers, Basic Data Types in C, variables, constants, Input/output statements in C.

**Textbook 1: Chapter 1.1 - 1.9, 2.1 - 2.2, 8.1 - 8.6, 9.1 - 9.14**

## UNIT - II

**DECISION CONTROL AND LOOPING STATEMENTS** **08 Hrs.**

Operators in C, Type conversion and typecasting, **Decision control and LOOPING STATEMENTS**

Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, go to statement.

**Textbook 1: Chapter 9.15 - 9.16, 10.1 - 10.6**

## UNIT - III

**FUNCTIONS AND ARRAYS** **08 Hrs.**

Functions - Introduction using functions, Function definition, function declaration, function call, return statement, passing parameters to functions,

scope of variables, storage classes, recursive functions. The inline Keyword Arrays - Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, two dimensional arrays, operations on two-dimensional arrays, two- dimensional arrays to functions, multidimensional arrays, applications of arrays.

**Textbook 1: Chapter 11.1 - 11.10, 12.1 - 12.10, 12.12**

## UNIT - IV

**STRINGS AND POINTERS** **08 Hrs.**

Introduction, string taxonomy, operations on strings, Miscellaneous string and character functions, arrays of strings. Pointers: Introduction to pointers, declaring pointer variables, Types of pointers, Passing arguments to functions using pointers.

Pointers (Contd...): Pointers to Functions, C's Dynamic Allocation Functions

**Textbook 1: Chapter 13.1 - 13.6, 14 - 14.7**

## UNIT - V

**STRUCTURE, UNION, AND ENUMERATED DATA TYPE** **08 Hrs.**

Introduction, structures and functions, Unions, unions inside structures, Enumerated data type.

Bit-Fields, Enumerations, Using sizeof to Ensure Portability, typedef

**FILES:** Introduction to files, using files in C, reading and writing data files. , Detecting end of file

**Textbook 1: Chapter 15.1 - 15.10, 16.1 - 16.5**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Reema Thareja | PROGRAMMING IN C, Third Edition, Oxford University, 2023 |
| 2 | Schildt, Herbert | "C the complete reference", 4th Edition, McGrawHill |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Brian W. Kernighan and Dennis M. Ritchie | The 'C' Programming Language, Second Edition, Prentice Hall of India, 2015 |
| 2 | Hassan Afyouni, Behrouz A. Forouzan | "A Structured Programming Approach in C", 4th Edition, Cengage |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts.

**CO2 :** Apply programming constructs of C language to solve the real world problem.

**CO3 :** Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting.

**CO4 :** Explore user-defined data structures like structures, unions, files and pointers in implementing solutions.

**CO5 :** Design and Develop Solutions to problems using modular programming constructs using functions.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 2 | | 3 | | 1 | | | | | | | 1 | |
| | **CO2** | 2 | | 3 | | 1 | | | | | | | 1 | |
| | **CO3** | 2 | | 3 | | 1 | | | | | | | 1 | |
| | **CO4** | 2 | | 3 | | 1 | | | | | | | 1 | |
| | **CO5** | 2 | | 3 | | 1 | | | | | | | 1 | |

# Elements of Biotechnology and Biomimetics

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | PSC6 |

**Course Objectives :** This course will enable students :

- Understand the basic concepts of Biomolecules to analyze the various properties.
- Outline the fundamental concepts of cell, molecular and genetics to assess the roles.
- Use the fundamentals of Bioprocess Engineering to create a synergy between biologists and engineers.
- Demonstrate the various uses and applications of biological databases.
- Explain the fundamental concepts of Biomimetics to analyze biomimicry and the future of innovation.

## UNIT - I

**FUNDAMENTALS OF BIOCHEMISTRY** **8 Hrs.**

**Carbohydrates**: Introduction to carbohydrates, sources of carbohydrates, three major size classes of carbohydrates (mono, di, and polysaccharides), and classification of monosaccharides based on number of C-atoms (classification based on functional groups: aldoses and Ketoses).

**Nucleic Acids:** Introduction to Nucleic Acids, purine & pyrimidines, nucleosides, nucleotides of DNA & RNA, base pairing, structure of DNA, Structure of RNA, and types of RNA. Properties of Nucleic Acids.

**Proteins:** Introduction to Proteins: Amino acids (Structure, classification, and properties of amino acids). Structural organization: Primary structure, Secondary structure, Tertiary structure, and quaternary structure of proteins.

## UNIT - II

**FUNDAMENTALS OF CELL, MOLECULAR, AND GENETICS** **08 Hrs.**

Introduction to Genetics, Mendelian Genetics and laws, Monohybrid and dihybrid cross, back cross and test cross, Conceptual numerical. Linkage and crossing over in Drosophila Melanogaster (C is and Trans arrangement of genes, types of linkage, crossing-over types and mechanism of crossing-over),

Cell and Cell Structure (Prokaryotes and Eukaryotes), Cell Division and Cell Cycle. Central dogma of Molecular biology. Cell growth, senescence, and cell death.

## UNIT - III

**FUNDAMENTALS OF BIOPROCESS ENGINEERING 08 Hrs.**

Introduction to bioprocess engineering, Biotechnology and Bioprocess engineering, the biologists and biotechnology engineers, research approaches, the story of penicillin, synergy between biologists and engineers, bioprocesses and regulatory constraints.

## UNIT - IV

**FUNDAMENTALS OF BIOINFORMATICS 08 Hrs.**

Introduction to Biological Databases (Definition of Bioinformatics, Goals, Scope, Application, Limitations, and New Themes). Database: (Definition of database, Types), Biological database: Databases (Primary, Secondary and Specialized), Interconnection between the databases, Pit falls of biological databases. Nucleotide and Protein sequence and structure databases (NCBI, EMBL, DDBJ, Uniprot, and PDB). Other Important Databases: KEGG, PubMed, PubChem, ZINC.

## UNIT - V

**BIOMIMETICS AND ITS APPLICATIONS 08 Hrs.**

Introduction to Biomimetics (definition and its evolution), Biomimicry problem definition and solution (Lotus leaves, Kingfisher beak, and Bird fly), tools and techniques: Discovery tools, Biomimicry software and database, Biomimicry and the future of innovation (material science, energy and sustainability, medicine and water purification).

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Nelson D.L. & Cox, M. M | Lehninger principles of 7th Ed. ISBN - 9781319108243, W.H. Freeman, 2017 |
| 2 | Xiong, Jin | Essential Bioinformatics. ISBN -10.0521706106, Cambridge University Press, 2006 |
| 3 | DeLisa, Matthew, etal., Micheal L Shuler and FikertKargi | Bioprocess Engineering : Basic Concepts, ISBN-13:978- 0137062706. Pearson, 2017. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | David Freifelder | Molecular Biology, 2nd ed, 834p, ISBN-8185198349, 1987 |
| 2 | Lewin, Benjamin and Gabby Dover | Genesv. ISBN-9780198542889, Vol. 1110. Oxford: Oxford University Press,1994. |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Apply the basic concepts of Biomolecules to analyze the various properties.

**CO2 :** Outline the fundamental concepts of cell, molecular and genetics to assess the roles.

**CO3 :** Use the fundamentals of Bioprocess Engineering to create a synergy between biologists and engineers.

**CO4 :** Illustrate the various uses and applications of biological databases.

**CO5 :** Apply the fundamental concepts of Biomimetics to analyze biomimicry and the future of innovation.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | 3 | 1 | | | 1 | | | | | | 1 | | | 3 |
| | **CO2** | 3 | | | | 1 | | | | | | 1 | | | 3 |
| | **CO3** | 3 | 2 | | | 1 | | | | | | 1 | 3 | | |
| | **CO4** | 3 | 1 | | 2 | 1 | | | | | | 1 | | 3 | |
| | **CO5** | 3 | 3 | 1 | | 1 | | | | | | 1 | | | 3 |

# Building Materials Lab

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Laboratory | Course Code | : | PSCL1 |

**Course Objectives :** This course will enable students :

- Perform testing on various ingredients used in concreting as per Indian Standards.
- Perform lab tests on hardened concrete, tiles, bricks and Reinforcement bars.

## UNIT - I

- Determination of bulking of sand and grain size distribution
- Determination of flakiness index and elongation index
- Determination of fineness and normal consistency of cement
- Determination of initial and final setting time
- Casting concrete cubes and cylinder for nominal/design mix
- Determination of workability by Slump test
- Determination of compressive, split tensile and flexural strength of concrete specimens
- Determination of flexural strength and compressive strength of floor tiles
- Determination of compressive strength of solid blocks and bricks
- Determination of tensile strength of HYSD/TMT bars

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Duggal S.K | "Building materials", New Age International publishers, second edition. 4835/24, Ansari Road, Daryaganj, New Delhi-110 002, 2003. ISBN 81-224-1435-4 |
| 2 | Shetty M.S | "Concrete Technology", S. Chand & Company Ltd., 2006 |
| 3 | M.L. Gambhir | Concrete Manual, Dhanpat Rai and Co. |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Evaluate the quality of materials used for building construction.

**CO2 :** Prepare a detailed report of the material testing carried out.

**CO3 :** Relate the experimental procedure and results to the quality of the tested materials.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | | | | | 2 | | | | | | 1 | 1 | | |
| | **CO2** | | | | | | | | | 2 | | 1 | 1 | | |
| | **CO3** | 3 | | | | | | | | | | 1 | 1 | | |
| | **CO4** | | | | | | | | | | | 1 | | | |

# Elements of Mechanical Engineering Lab

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Laboratory | Course Code | : | PSCL2 |

**Course Objectives :** This course will enable students :

- Provide hands-on experience in fabricating simple sheet metal components from surface development and joining them using soldering techniques.
- Train students in basic turning operations using a lathe to achieve specified dimensions on work pieces.
- Develop skills for conducting standard laboratory tests on fuels to determine properties such as flash point, fire point, viscosity, and density.
- Fabricate standard welded joints using electric arc welding with proper safety.
- Foster the ability to analyze experimental results and relate the findings to real-world applications in engineering manufacturing and thermal systems.

## PART - A

**CONVENTIONAL EXPERIMENTS** **16 Hrs.**

1. **Sheet metal and Soldering:** Development of lateral surfaces of square prism, Rectangular tray, cylinder, funnel. Minimum 3 models involving development and soldering.
2. **Turning Practice:** Machining of a model involving the turning operations like facing, counter sinking, plain turning, step turning and knurling operations.

## PART - B

**TYPICAL OPEN-ENDED EXPERIMENTS** **10 Hrs.**

1. Comparative study of flash point and fire point of various liquid fuels / oils using the open cup method.
2. Comparative study of flash point and fire point of various liquid fuels / oils using the closed cup method.
3. Comparative study on viscosity of different liquid fuels.
4. Comparative study on density of different liquids.
5. **Welding shop:** Study of electric arc welding tools & equipment. Fabricate the at least two types of joints using electric arc welding.

## TEXT BOOKS :

| | | |
|---|---|---|
| **Along with Lab Manual provided by Mechanical Engineering Department, students are advised to follow text book.** | | |
| 1 | Choudhury S.K.H. and others | Elements of Workshop Technology – Vol.1&2. Edition II, Media Promoters and Publishers, Mumbai, 2001 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | P.N. Rao | Manufacturing Technology: Vol. 1 (McGraw Hill), 5th edition, 2018<br>Manufacturing Technology: Vol. 2 (McGraw Hill), 4th edition, 2019 |
| 2 | R.K. Rajput | Thermal Engineering, Laxmi Publications (New Delhi) 9th edition 2024 |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Prepare sheet metal components by developing lateral surfaces and perform soldering to assemble models with accuracy.

**CO2 :** Carry out basic turning operations on a lathe such as facing, countersinking, plain turning, step turning, and knurling to achieve required dimensions and finish.

**CO3 :** Determine and compare important fuel properties such as flash point, fire point, viscosity, and density using standard laboratory methods.

**CO4 :** Fabricate different types of welding joints such as butt, lap, and T/L joints using electric arc welding tools while following safety procedures.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **COs** | **CO1** | 2 | 2 | 2 | | 2 | | | | 1 | 1 | | 1 | 3 | | |
| | **CO2** | 2 | 1 | 2 | 1 | 2 | | | 1 | 1 | 1 | | 1 | 3 | | |
| | **CO3** | 2 | 2 | | 3 | 2 | | 1 | | | 2 | | 1 | | | 3 |
| | **CO4** | 2 | 1 | 2 | | 2 | 2 | 1 | 1 | 2 | 1 | | 2 | 3 | | |

# Basic Electrical Laboratory

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Laboratory | Course Code | : | PSCL3 |

**Course Objectives :** This course will enable students :

- Understand and Verify Fundamental Electrical Laws.
- Measure Electrical Parameters Accurately.
- Design and Implement Practical Electrical Circuits.
- Evaluate and Interpret Experimental Data.

| Sl. No. | Name of Experiment |
|---|---|
| | **PART – A**<br>**CONVENTIONAL EXPERIMENTS** |
| 1 | Verification of Ohm's law and Kirchhoff's laws for DC circuits. |
| 2 | Speed-torque characteristics of DC shunt motor. |
| 3 | Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and wattmeter in single-phase AC circuits. |
| 4 | Load test on single phase transformer. |
| 5 | Measurement of three-phase power of an inductive load by 2-wattmeter method, when the load is (a) star connected and (b) delta connected. Calculation of resistance, reactance, impedance and power factor. |
| 6 | Wiring an appropriate electric circuit, understanding the basic principle used for 2-way and 3-way control of load. |
| | **Part – B**<br>**OPEN-ENDED EXPERIMENTS** |
| 7 | Creation of short circuit to determine the time taken by a fuse of different length. Documenting the test data and the conclusions. |

| | |
|---|---|
| 8 | Trouble shooting experiments in simple DC circuits. The trouble may be due to improper connection, faulty component leading to open circuits or short circuits. Detection of fault and the reasons for that and conclusion. |
| 9 | Measurement of voltage between line and neutral, ground and line, ground and neutral in respect of heathy an unhealthy 3-pin socket. Conclusions arrived for the faulty wiring. Allowable ground voltage. |
| 10 | A 12 V battery is available. It is required to obtain 3 V from the battery to charge a mobile. Create a circuit to obtain the required voltage. Specify all the ratings of the components used. |
| 11 | Only three ammeters and standard resistance are available in the laboratory. Using the same measure the single-phase power consumed by an inductive load. |
| 12 | Only three voltmeters and standard resistance are available in the laboratory. Using the same measure the single-phase power consumed by a capacitive load. |
| | **NOTE :**<br>i. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum mark for laboratory course is 100.<br>ii. Both PART-A and PART-B are considered for CIE and SEE.<br>iii. Students have to answer 1(one) question from PART-A and 1(one) question from PART-B.<br>iv.<br>• The questions set for SEE shall be from amongst the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.<br>• The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.<br>v. For continuous internal evaluation, during the semester classwork, the typical open-ended questions may be selected from PART-B or there may be any other similar question to enhance the skill of the students. |

## Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Conduct standard electrical experiments to verify theoretical principles.

**CO2 :** Measure key electrical parameters such as resistance, inductance, impedance, power, and power factor with standard methods.

**CO3 :** Design and perform experiments to solve practical open-ended electrical problems.

**CO4 :** Analyse experimental data from non-routine method to arrive at a solution.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **COs** | **CO1** | 2 | 1 | | | | | | | 2 | 2 | | | | |
| | **CO2** | 2 | 1 | | | | | | | 2 | 2 | | | | |
| | **CO3** | 2 | 1 | | | | | | | 2 | 2 | | | | |
| | **CO4** | 2 | 1 | | | | | | | 2 | 2 | | | | |

# Fundamentals of Electronics and Communication Laboratory

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Laboratory | Course Code | : | PSCL4 |

**Course Objectives :** This course will enable students :

- Understand the characteristics and applications of semiconductor devices.
- Analyze various applications of Operational Amplifier.
- Learn the truth table of digital ICs and design combinational circuits.
- Understand the concept of amplitude modulation.

| PART – A<br>CORE / BASIC HARDWARE EXPERIMENTS | |
|---|---|
| 1 | Design and Testing of Half-Wave Rectifier with and without Filter for determining Ripple Factor, Voltage Regulation, and Efficiency. |
| 2 | Design and Testing of Full-Wave Rectifier with and without Filter for determining Ripple Factor, Voltage Regulation, and Efficiency. |
| 3 | Analysis of Input and Output Characteristics of a Bipolar Junction Transistor in a Common Emitter Configuration. |
| 4 | Study of Transfer and Drain Characteristics of a MOSFET in Common Source Configuration. |
| 5 | Investigation of Op-Amp in Inverting and Non-Inverting Modes with Gain Measurement. |
| 6 | Study of Truth Tables for OR, AND, NOT, NAND, and NOR Gates using Basic and Universal Gates. |

| PART – B<br>OPEN-ENDED EXPERIMENTS | |
|---|---|
| 1 | Design and Testing of Clipping and Clamping Circuits to obtain desired Transfer Characteristics |

| | |
|---|---|
| 2 | Design and testing of a single stage bipolar junction transistor amplifier to obtain desired gain and bandwidth requirements. |
| 3 | Testing of Op-Amp as voltage follower and a weighted summer with waveform analysis. |
| 4 | Design and Testing of Integrator and Differentiator Circuits using Op-Amp with Waveform Analysis |
| 5 | Amplitude Modulation using Discrete Components for given Specifications. |
| 6 | Realization of Half/ Full Adder and Subtractor using Logic Gates. |

**Course Outcomes :**

Upon completion of this course, students will be able to :

**CO1 :** Demonstrate the characteristics and applications of semiconductor devices.

**CO2 :** Design various applications of Operational Amplifier.

**CO3 :** Analyze the functionality of logic gates and their applications.

**CO4 :** Investigate amplitude modulation to explore fundamental analog communication technique.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 2 | | | | | | 2 | 2 | | | 1 | |
| | **CO2** | 3 | 2 | | | | | | 2 | 2 | | | 1 | |
| | **CO3** | 3 | 2 | | | | | | 2 | 2 | | | 1 | |
| | **CO4** | 2 | 1 | | | | | | 2 | 2 | | | 1 | |

# C Programming Lab

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Laboratory | Course Code | : | PSCL5 |

**Course Objectives :** This course will enable students :

- Elucidate the basic architecture and functionalities of a computer.
- Apply programming constructs of C language to solve real-world problems.
- Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems
- Design and Develop solutions to problems using structured programming constructs such as functions and procedures.

| | PROGRAMS |
|---|---|
| 1 | **a. School Calculator**<br>A school application needs to find the roots of a quadratic equation entered by the user. Write a C program to read the non-zero coefficients and display all the roots of the equation.<br>**b. Student Name Checker**<br>A student name-processing program needs to convert lowercase letters to uppercase and uppercase letters to lowercase. It should also count the number of vowels and consonants in the entered string. Write a C program to perform these operations. |
| 2 | **a. Number Checker**<br>A number-checking application receives an integer from the user. Write a C program to find the sum of all its digits and check whether the number is a palindrome.<br>**b. Student Roll Number Search**<br>A class teacher has a list of student roll numbers already arranged in ascending order. Write a C program to search for a given roll number using Binary Search. Display a suitable success or failure message and the number of probes used. |
| 3 | **a. Prime Number Finder**<br>A mathematics application wants to list all prime numbers between two numbers entered by the user. Write a C program to display the prime numbers and the total number of prime numbers found. |

| | |
|---|---|
| | **b. Club Member Lists**<br>Two college clubs maintain lists of member IDs. Write a C program to find the union of the two sets, displaying all IDs that belong to either club. |
| 4 | **a. Calculator for Sine**<br>A simple scientific calculator needs to calculate the sine of an angle using a specified number of terms. Write a C program to find sin(x) using the series $\sin(x) = x - x^3/3! + x^5/5! - x^7/7! + \ldots$ .<br>**b. Matrix Calculator**<br>A college application stores two matrices and needs to multiply them. Write a C program to find the product matrix and then find the trace of the product matrix. |
| 5 | **a. Scientific Calculator**<br>A scientific calculator needs to display the cosine value for angles from 0° to 180° in steps of 10°. Write a C program using the series $\cos(x) = 1 - x^2/2! + x^4/4! + \ldots$ for 10 terms.<br>**b. Power Calculator**<br>A simple calculator needs to calculate x raised to the power n. Write a recursive C function to compute $x^n$, where x and n are integer values. |
| 6 | **a. String Utility**<br>A basic text-processing program needs to perform string operations without using built-in functions. Write a C program to implement any two of the following operations: STRCPY, STRREV, STRLEN, STRNCAT.<br>**b. Student Name List**<br>A college office has the names of N students and wants them arranged alphabetically. Write a C program to accept N names and sort them using Bubble Sort |
| 7 | **a. Marks Sorting**<br>A teacher has the marks of N students in an array. Write a C program to sort the marks in ascending order using Selection Sort and display both the original and sorted arrays with suitable headings.<br>**b. Reverse Number List**<br>A student wants to display a list of numbers in reverse order. Write a C program to read the array elements using pointers and reverse the array using pointers. Display the elements using pointers. |
| 8 | **a. Class Marks Statistics**<br>A teacher has an array containing the marks of N students. Write a C program to find the mean, variance and standard deviation of the marks. |

| | |
|---|---|
| | **b. Classroom Seating Matrix**<br>A college classroom is represented using an M × N matrix. Write functions to read the matrix, display the matrix, find the sum of each row and find the sum of each column. |
| 9 | **a. Student ID Search**<br>A college office stores N student IDs in an array. Write functions to read and display the array and to perform a Linear Search for a given ID. Display suitable messages for successful and unsuccessful searches.<br>**b. Word Checker**<br>A simple word-checking application needs to determine whether a given word is a palindrome. Write a C program to check this without using built-in string functions |
| 10 | **a. Student Marks Report**<br>A college wants to maintain the details of N students using a structure containing USN, Name, Marks1, Marks2 and Marks3. Write a C program to find the total marks and percentage of each student and display all details in a suitable format.<br>**b. Simple Factorial Calculator**<br>A calculator application needs to find the factorial of a given integer. Write a recursive C function to calculate the factorial. |

| **OPEN-ENDED PROGRAMS** | |
|---|---|
| 1 | A small warehouse tracks how many units of different products are shipped from multiple branches. Another dataset shows how much revenue each product generates per unit. Develop a C program which combines these datasets to calculate the total revenue generated by each branch. |
| 2 | A currency exchange booth allows users to convert between two currencies. Before confirming the exchange, the system simulates a swap of the values to preview the result without changing the original data. In other cases, it updates the actual values. Develop a C program that implements both behaviors using Call by Value and Call by reference. |
| 3 | Two students have lists of courses they have enrolled in. Write a C program to find the intersection of the two sets, displaying the courses that both students have enrolled in. |

| | |
|---|---|
| 4 | A college wants to store the marks of n students, where n is entered at runtime. Write a C program using dynamic memory allocation and pointers to allocate memory, read the marks, calculate the average, and release the allocated memory. |
| 5 | A numerical application stores a list of integers. Write a menu-driven C program using pointers to perform operations such as insertion, deletion, searching, and displaying elements in the array. |
| 6 | A bank stores customer transaction details in a file. Write a C program to read the transaction records and calculate the total deposit and withdrawal amounts for a particular customer. |

**Course Outcomes :**

Upon completion of this course, students will be able to :

**CO1 :** Develop, Debug and Execute programs to solve simple computational problems.

**CO2 :** Develop, Debug and Execute programs to demonstrate decision making and looping constructs.

**CO3 :** Develop, Debug and Execute programs to demonstrate the applications of array and strings.

**CO4 :** Develop, Debug and Execute programs to demonstrate the basic concepts of Function and pointers.

**CO5 :** Develop, Debug and Execute programs to demonstrate the basic concepts of structures and Union.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | 2 | | 3 | | 3 | | | | | | | | | |
| | **CO2** | 2 | | 3 | | 3 | | | | | | | | | |
| | **CO3** | 2 | | 3 | | 3 | | | | | | | | | |
| | **CO4** | 2 | | 3 | | 3 | | | | | | | | | |
| | **CO5** | 2 | | 3 | | 3 | | | | | | | | | |

# Elements of Biotechnology Laboratory

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 0(L)+0(T)+2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Laboratory | Course Code | : | PSCL6 |

**Course Objectives :** This course will enable students :

- Understand the various instrumentation and sterilization principles.
- Describe basic concepts of preparation of the solutions.
- Understand the microscopic use for the study of cells like plants, bacteria etc

| LIST OF EXPERIMENTS | |
|---|---|
| 1 | Instrumentation and working principles of Microscopes, calorimeters and pH meters |
| 2 | Sterilization techniques: Hotairoven, Autoclave and Laminar Air flow unit |
| 3 | Concentration of solutions: Normality, Molarity and buffer solutions |
| 4 | Study of different stages of mitosis(onion root tip experiment)and meiosis |
| 5 | Study of mutations in *Drosophila Melanogaster* |
| 6 | Study of cross section of different parts of a plant |
| 7 | Identification of bacterial and fungal organisms by staining |
| 8 | Qualitative test to identify types of biomolecules: Carbohydrates and proteins |
| 9 | Scientific article retrieval using biological databases |
| 10 | Sequence retrieval using biological databases |
| 11 | Biomolecular structure visualization and analysis using PyMOL and VMS |
| 12 | Determination of bacterial cell growth using turbidometry method |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Nelson, D.L., & Cox, M. M | Lehninger principles of biochemistry 7th ed. W.H.Freeman, ISBN-9781319108243, 2017 |
| 2 | Xiong, Jin | Essential bioinformatics, Cambridge University Press, ISBN-10.0521706106,2006 |
| 3 | David Freifelder | Molecular Biology, ISBN-978-9350781210, 2nd ed, 834p |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Lewin, Benjamin and Gabby Dover. | Genesv. ISBN-9780198542889, Vol. 1110. Oxford: Oxford University Press,1994. |

### Course Outcomes :

Upon completion of this course, students will be able to :

**CO1 :** Describe the various instrumentation and sterilization principles.

**CO2 :** Explain the basic concepts of preparation of the solutions.

**CO3 :** Analyze the microscopic use for the study of cells like plants, bacteria etc.

**CO4 :** Apply the knowledge of carbohydrates and proteins to analyze the biological samples.

**CO5 :** Demonstrate the basics of biological databases for Biomolecular visualization.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | 3 | | | | | | 1 | | | 1 | | | | 3 |
| | **CO2** | 3 | | | | | | 1 | | | 1 | | | | 3 |
| | **CO3** | 3 | 2 | | | 1 | | 1 | 2 | | 1 | | | | 3 |
| | **CO4** | 3 | 2 | | | 1 | | 2 | | | 1 | | | | |
| | **CO5** | 3 | 2 | | | 2 | 1 | 2 | | | 1 | | | 3 | |

# Introduction to Electrical Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO6 |

**Course Objectives :** This course will enable students :

- Introduce different types of electric power systems.
- Interpret the fundamental concepts of electric circuits.
- Impart knowledge of construction and operation of DC machines
- Impart knowledge of construction and operation of AC machines
- Study the domestic wiring, tariff and electrical safety practices.

## UNIT - I

**POWER GENERATION** **08 Hrs.**

Conventional and non-conventional energy resources; Hydel, thermal, nuclear, Solar & wind power generation (Block Diagram approach). Single-line diagram of power supply system showing power station, transmission system and distribution system. Definition of power grid.

**DC CIRCUITS**

Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Numerical.

## UNIT - II

**SINGLE PHASE CIRCUITS** **08 Hrs.**

Generation of single-phase system. Equation of AC voltage and current, average value, RMS value, form factor, peak factor and their relation [No derivations]. Voltage and current relationships in R, L and C circuits, concept of power, reactive power, apparent power and power factor, analysis of R-L, R-C and R-L-C series circuits, parallel circuits, illustrative examples.

**THREE PHASE CIRCUITS**

Generation of three-phase systems, star and delta (mesh) connections, relation between phase and line values of voltages and of currents of star and

delta connections. Definition of balanced and unbalanced source and load. Power, reactive power and power factor. Problems with balanced loads.

## UNIT – III

**DC MACHINES** **08 Hrs.**

**DC GENERATOR**

Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Numerical.

**DC MOTOR**

Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and speed control (armature & field) of DC motors (series & shunt only). Rating, cost, size and applications of DC motors. Numerical.

## UNIT - IV

**TRANSFORMERS** **08 Hrs.**

Necessity of transformer, principle of operation, Types and construction of single- phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency. Rating, cost, size and applications. Numerical.

**THREE-PHASE INDUCTION MOTORS**

Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance Rating, cost, size and applications. Numerical.

## UNIT – V

**DOMESTIC WIRING** **08 Hrs.**

Requirements, Types of wiring: conduit, casing & capping. Two way and three way control of load

**ELECTRICAL ENERGY CONSUMPTION AND TARIFF**

Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff, calculation of electrical energy consumption for domestic applications.

**SAFETY MEASURES**

Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | D C Kulshreshtha | Basic Electrical Engineering, Tata McGraw Hill, 1st Ed., 2019, ISBN-13: 9789353167219 |
| 2 | D. P. Kothari and I. J. Nagrath | Basic Electrical Engineering, Tata McGraw Hill, 4th Ed., 2019, ISBN-13**:** 9789353165727 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | V. K. Mehta, Rohit Mehta | Principles of Electrical Engineering & Electronics, S. Chand & Company Publications, 2nd Ed., 2015. ISBN-13: 9788121927291 |
| 2 | E. Hughes | Electrical Technology, Pearson, 12th Ed., 2016. ISBN-13: 978-1-292-09304-8 |

**Course Outcomes :**

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

**CO1 :** Explain the concepts of various energy sources and Electric circuits.

**CO2 :** Apply the basic Electrical laws to solve circuits.

**CO3 :** Explain the construction and operation of various Electrical Machines.

**CO4 :** Determine the performance parameters of different Electrical Machines.

**CO5 :** Explain the concepts of domestic wiring, circuit protective devices and safety measures.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | 2 | 1 | | | | | | | | | | |
| | **CO2** | 3 | 3 | | | | | | | | | | | |
| | **CO3** | 3 | 2 | | | | | | | | | | | |
| | **CO4** | 3 | 2 | | | | | | | | | | | |
| | **CO5** | 3 | 1 | | | | | | | | | | | |

# Introduction to Electronics and Communication Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO7 |

**Course Objectives :** This course will enable students :

- Analyze various stages of DC power supply.
- Understand the working of amplifiers and oscillators.
- Build the analog computational circuits using OP-AMP
- To equip students with basic foundations of embedded systems.
- Understand basics of digital electronics.
- Understand basics of analog and digital modulation techniques.

## UNIT - I

**POWER SUPPLIES** **08 Hrs.**

Block diagram, Half-wave rectifier, Full-wave rectifiers (Bi phase and Bridge), C- filter (Qualitative analysis), Zener voltage regulator, Line and load regulation, Voltage doubler, switched mode power supply

**AMPLIFIERS**

Review of BJT, BJT as a switch; Cut-off and saturation modes; RC coupled CE amplifier, frequency response, gain, input and output resistance, bandwidth, phase shift, negative feedback.

## UNIT - II

**OPERATIONAL AMPLIFIERS** **08 Hrs.**

Ideal op-amp; parameters and characteristics of ideal and practical op-amp; Practical op-amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, subtractor.

**OSCILLATORS**

Concept of positive feedback, Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, RC phase shift oscillator, Wein bridge oscillator,

Multivibrators, Single-stage astable oscillator, Crystal controlled oscillators (using Op-amp, qualitative analysis).

## UNIT – III

**BOOLEAN ALGEBRA AND LOGIC CIRCUITS** **08 Hrs.**

Binary numbers, Number Base Conversion, Binary, octal, decimal & Hexa Decimal Numbers and vice versa, Complements -1's and 2's, Basic definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

**COMBINATIONAL LOGIC**

Introduction, Design procedure, Adders- Half adder, Full adder.

## UNIT - IV

**EMBEDDED SYSTEMS** **08 Hrs.**

Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Purpose of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC, Memory-ROM

**SENSORS AND INTERFACING**

Sensors, Actuators, LED, 7-Segment LED Display.

## UNIT – V

**ANALOG COMMUNICATION SCHEMES** **08 Hrs.**

Introduction, Modern communication system scheme: Information source, input transducer, Transmitter, Channel or Medium, Noise, Receiver, Multiplexing, Concept of modulation, Types of communication systems. Types of modulation (only concepts) – AM, FM, Concept of Radio wave propagation (Ground, space, sky)

**DIGITAL MODULATION SCHEMES**

Advantages of digital communication over analog communication, ASK, FSK, PSK (explanation with waveform).

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Mike Tooley | Electronic Circuits, Fundamentals & Applications, 4th Edition, Elsevier, 2015 |
| 2 | M. Morris Mano | Digital Logic and Computer Design, PHI Learning, 2017 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | D P Kothari, I J Nagrath | Basic Electronics, 2nd edition, McGraw Hill Education (India), Private Limited, 2018 |
| 2 | Shibu K. V | Introduction to Embedded Systems, 2nd edition, Tata Mc Graw Hill Education Pvt. Ltd., 2017 |
| 3 | S L Kakani and Priyanka Punglia | Communication Systems, Ist Edition, New Age International Publisher, 2017 |

### Course Outcomes :

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

**CO1 :** Analyse basic electronic circuits using the principles of rectifiers, voltage regulators, and amplifiers.

**CO2 :** Analyse the behaviour of analog circuits including oscillators and operational amplifiers in signal generation and conditioning applications.

**CO3 :** Apply number system conversions and Boolean algebra to design and implement basic combinational logic circuits.

**CO4 :** Interpret the structure and functionality of embedded systems and digital logic components such as microcontrollers, sensors, and logic gates.

**CO5 :** Illustrate the fundamental concepts of analog and digital modulation techniques based on their characteristics and suitability for communication systems.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 3 | | | | 1 | | 1 | 1 | 1 | | 1 | 3 | 1 |
| | **CO2** | 3 | | | | 1 | | 1 | 1 | 1 | | 1 | 3 | 1 |
| | **CO3** | 3 | | | | 1 | | 1 | 1 | 1 | | 1 | 3 | 1 |
| | **CO4** | 3 | | | | | | | | | | | 3 | |
| | **CO5** | 3 | | | | | | | | | | | 3 | |

# Introduction to Mechanical Engineering

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO8 |

**Course Objectives :** This course will enable students :

- To develop basic knowledge on mechanical engineering, fundamentals and energy sources.
- Understand the concept of different types of machine tool operations and modernmanufacturing processes like CNC, 3D printing.
- To know the concept of IC engines and future mobility vehicles.
- To give exposure in the field of engineering materials and manufacturing processes technology and its applications.
- To acquire a basic understanding role of mechanical engineering in the robotics andautomation in industry.

## UNIT - I

**INTRODUCTION** **08 Hrs.**

Role of Mechanical Engineering in Industries and Society, Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive and Aerospace. **(PO1)**

**ENERGY**

Introduction to various Energy Sources, Basic working principles of Thermal power plant, nuclear power plant, Solar power plant and Wind power plant. Environmental issues like Global warming and Ozone depletion. **(PO1, PO7)**

## UNIT - II

**MACHINE TOOL OPERATIONS** **08 Hrs.**

Working Principle of lathe, Lathe operations: Turning, facing, knurling. Working principles of Bench Type Drilling Machine, drilling operations: drilling, boring, reaming. Working of Horizontal Milling Machine, Milling operations: plane milling and slot milling. **(PO1)**

**INTRODUCTION TO ADVANCED MANUFACTURING SYSTEMS**

Introduction, components of CNC, advantages and applications of CNC, Introduction to 3D printing and 3D printing by stereolithography process**. (PO1)**

## UNIT – III

**INTRODUCTION TO IC ENGINES**

Components and Working Principles, 4-Strokes Petrol and Diesel Engines, comparison of 4-stroke Petrol and Diesel engine, Application of IC Engines. **(PO1)**

**INSIGHT INTO FUTURE MOBILITY** **08 Hrs.**

Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles. **(PO1)**

## UNIT - IV

**ENGINEERING MATERIALS** **08 Hrs.**

Properties and applications of Ferrous & Nonferrous Metals, silica, ceramics, glass, graphite, diamond and polymer, Shape Memory Alloys. **(PO1)**

**JOINING PROCESSES**

Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding and types of flames. **(PO1)**

## UNIT – V

**INTRODUCTION TO MECHATRONICS & ROBOTICS (MODIFIED)** **08 Hrs.**

Open-loop and closed-loop mechatronic systems, Classification of Robots: Robot Anatomy, Application, Advantages and Disadvantages. **(PO1)**

**AUTOMATION IN INDUSTRY**

Definition, types – Fixed, programmable and flexible automation, basic elements with block diagrams, advantages. **(PO1)**

**INTRODUCTION TO IoT**

Definition and Characteristics, Physical design, protocols, Logical design of IoT, Functional blocks, and communication models**. (PO1)**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K R Gopala Krishna | Elements of Mechanical Engineering, Subhash Publications, 2008 |
| 2 | Jonathan Wickert and Kemper Lewis | An Introduction to Mechanical Engineering, Third Edition, 2012 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Hazra Choudhry and Nirzar Roy | Elements of Workshop Technology (Vol. 1 and 2), Media Promoters and Publishers Pvt. Ltd., 2010. |
| 2 | P.N. Rao | Manufacturing Technology- Foundry, Forming and Welding, Tata McGraw Hill 3rd Ed., 2003 |
| 3 | V. Ganesan | Internal Combustion Engines, Tata McGraw Hill Education; 4th edition, 2017 |
| 4 | Appu Kuttan K K | Robotics, International Pvt Ltd, volume 1 |
| 5 | Dr SRN Reddy, Rachit Thukral and Manasi Mishra | Introduction to Internet of Things: A Practical Approach, ETI Labs |
| 6 | Raj Kamal | Internet of Things: Architecture and Design, McGraw Hill |

### Course Outcomes :

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

**CO1 :** Explain the role of mechanical engineering in industries and society, various energy sources and its impact on environment.

**CO2 :** Describe the machine tool operations and advanced manufacturing process.

**CO3 :** Explain the working principle of IC engines, electric and hybrid vehicles.

**CO4 :** Discuss the properties of common engineering materials and various metal joining processes.

**CO5 :** Explain the concepts of mechatronics, robotics and automation in IoT.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | 2 | | | | | | 2 | | | | | | |
| | CO2 | 2 | | | | | | | | | | | | |
| | CO3 | 2 | | | | | | | | | | | | |
| | CO4 | 2 | | | | | | | | | | | | |
| | CO5 | 2 | | | | | | | | | | | | |

# Essentials of Information Technology

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 42 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO9 |

**Course Objectives :** This course will enable students :

- Provide fundamental knowledge of computer systems, software and networks.
- Develop skills in using productivity tools for academic and professional tasks.
- Enable effective use of internet and communication technologies.
- Introduce emerging trends and applications in IT.
- Create awareness of ethical, legal, and security issues in IT.
- Impart practical skills for digital literacy and employability.

## UNIT - I

**DATA STORAGE** **09 Hrs.**

Bits and Their Storage, Main Memory, Mass Storage, The Binary System, Storing Integers.

**DATA MANIPULATION**

Computer Architecture, Machine Language, Program Execution, Arithmetic/ Logic Instructions, Communicating with Other Devices.

**Textbook 1: Chapter-1 (1.1-1.3, 1.5-1.6), Chapter-2 (2.1-2.5)**

## UNIT - II

**OPERATING SYSTEMS** **09 Hrs.**

The History of Operating Systems, Operating System Architecture, Coordinating the Activities, Handling Competition Among Processes, Concept of Algorithms and Pseudocode

**Textbook 1: Chapter-3, Chapter-5 (5.1)**

## UNIT – III

**NETWORKING AND THE INTERNET** **08 Hrs.**

Network Fundamentals: Network Classifications, Protocols, Combining Networks, Methods of Process Communication, The Internet: Internet Architecture, The World Wide Web: Web Implementation, Client-Side and Server-Side Activities, Internet Protocols.

**CYBERSECURITY**

Overview - What is Cybersecurity? The Basic Information Security Model, Cyber Hygiene.

**ETHICAL ISSUES IN INFORMATION TECHNOLOGY**

Overview, Ownership Rules, Ethics and Online Content.

**Textbook 1: Chapter-4,Textbook 2: Chapter-16, Chapter-17**

## UNIT - IV

**SOFTWARE ENGINEERING** **08 Hrs.**

The Software Engineering Discipline, The Software Life Cycle, Software Engineering Methodologies, Modularity.

**DATABASE SYSTEMS**

Database Fundamentals, The Relational Model.

**Textbook 1: Chapter-7 (7.1-7.4), Chapter-9 (9.1-9.2)**

## UNIT – V

**INTRODUCTION TO HTML AND WEBSITE DEVELOPMENT** **08 Hrs.**

What is HTML? Cascading Style Sheets (CSS), Website Design and Storyboarding, Structure of a Website.

**COMPUTER GRAPHICS**

The Scope of Computer Graphics, Overview of 3D Graphics

**Textbook 2: Chapter-12.**

**Textbook 1: Chapter-10 (10.1-10.2)**

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | J. Glenn Brookshear and Dennis Brylow | Computer Science: An Overview, 12th Edition, Pearson Education Limited, 2017 |
| 2 | Roy, Shambhavi; Daniel, Clinton; & Agrawal, Manish | "Fundamentals of Information Technology", Digital Commons at The University of South Florida (2023).https://digitalcommons.usf.edu/dit_tb_eng/19 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | V. Rajaraman | "Introduction to Information Technology", Third Edition, PHI Learning, 2018 |
| 2 | Pelin Aksoy | Information Technology in Theory, First Edition, Cengage |

### Course Outcomes :

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

**CO1 :** Illustrate the computer architecture with respect to the underlined components and their functioning.

**CO2 :** Describe operating system architecture with respect to process coordination and security.

**CO3 :** Interpret the role of cybersecurity and ethics issues in Information Technology (IT).

**CO4 :** Apply queries for quick insert, access and updating structured information.

**CO5 :** Develop structured websites using HTML and CSS principles including 3D modeling.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| **COs** | **CO1** | 2 | 2 | | | | | | | | | | 2 | | |
| | **CO2** | 2 | 1 | | | | | | | | | | 1 | | |
| | **CO3** | 2 | 1 | 2 | | | | | | | | | 1 | | |
| | **CO4** | 2 | 1 | | | | | | | | | | 1 | | |
| | **CO5** | 1 | 2 | | | 2 | | | 1 | 1 | | | 2 | 1 | |
| | **AVG** | 2 | 1 | | | | | | | | | | 1 | 1 | |

# Introduction to Building Sciences

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO10 |

**Course Objectives :** This course will enable students :

- Understand the scope of various Civil Engineering domains, materials and terminologies.
- Understand the laws governing mechanics, and the apply them to concurrent forces.
- Analyse the coplanar non-concurrent force system.
- Analyse the parallel force system, determine centroids and moment of inertia of laminae.
- Determine CG, surface areas, volumes and moment of inertia of 1D, 2D and 3D bodies.

## UNIT - I

**SCOPE OF VARIOUS FIELDS OF CIVIL ENGINEERING** **08 Hrs.**

Surveying, Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Construction Planning and Project Management.

**BASIC AND EMERGING MATERIALS OF CONSTRUCTION**

Types and Uses of Bricks, Stones, Cement, Structural Steel, Wood and Concrete. Types and Uses of Autoclaved Aerated Concrete (AAC) blocks, Bamboo, Recycled plastics, Material selection criteria, Durability, Sustainability.

**STRUCTURAL ELEMENTS OF A BUILDING**

Concept of Foundation, Plinth, Lintel, Chejja, Masonry wall, Column, Beam, Slab, Flooring and Staircase, Green building rating systems IGBC, LEED, GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings.

## UNIT - II

**FUNDAMENTALS OF MECHANICS** **08 Hrs.**

Introduction to Mechanics, Classification of Engineering Mechanics, Basic terminologies in Mechanics-time, mass, space, length, force, momentum,

Continuum, Rigid body, Particle, Characteristics of a force, Scalar and Vector quantities, Fundamentals Laws of Mechanics.

**COPLANAR CONCURRENT FORCES**

Composition of forces, Resolution of forces, General method of composition of forces, Equilibrium of bodies and connected bodies.

## UNIT – III

**COPLANAR NON-CONCURRENT FORCES 08 Hrs.**

Moment of a force, Varignon's theorem, Couple, resolution of force and a couple, resultant of force systems, equilibrium of coplanar non-concurrent system of forces, application to beam problems- Determination of support reaction for beams subjected to different types of loads (Concentrated loads, UDL, UVL, pure moment and their combinations), introduction to the concepts of determinacy and indeterminacy in components subjected to forces/loads.

## UNIT - IV

**CENTROID AND MOMENT OF INERTIA OF PLANE SECTIONS 08 Hrs.**

Importance of centroid and centre of gravity, methods of determining the centroid, locating the centroid of plane lamina from first principles, centroid of composite sections.

Importance of Moment of Inertia, parallel axis theorem and perpendicular axis theorem, section modulus, radius of gyration, polar moment of inertia, second moment of area (moment of inertia) of plane sections from first principles - rectangle, triangle, circle, moment of inertia of composite sections, Numerical Problems.

## UNIT – V

**CENTRE OF GRAVITY AND MASS MOMENT OF INERTIA 08 Hrs.**

Centre of gravity concept, centre of gravity from first principles of simple sections, Theorems of Pappus-Guldinus. Mass moment of inertia-determination of mass moment of inertia of rod, rectangular and circular plate from first principles.

**FRICTION**

Frictional force, Laws of friction, angle of friction, angle of repose and cone of friction, Concept of wedges.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | A. Nelson | Engineering Mechanics, Statics and Dynamics, Tata McGraw Hill Publications, 2009. ISBN:978-07-014614-3 |

| | | |
|---|---|---|
| 2 | Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan | Basic Civil Engineering and Engineering Mechanics, Laxmi Publications, 3rd Edition, 2015, ISBN: 9789380856674 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Beer F.P. and Johnston E.R. | Mechanics for Engineers: Statics and Dynamics, McGraw Hill, 4th Edition, 1987, ISBN: 9780070045842 |
| 2 | Hibbler R. C. | Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2017 |
| 3 | Timoshenko S, Young D. H., Rao J. V., Sukumar Patil | Engineering Mechanics, McGraw Hill Publisher,5th Edition, 2017, ISBN: 9781259062667 |
| 4 | Bhavikatti S S | Engineering Mechanics, New Age International Publications, 4th Edition, 2018 |

### Course Outcomes :

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

**CO1 :** Comprehend various civil engineering domains, materials & terminologies of buildings

**CO2 :** Solve engineering problems involving concurrent force systems using laws of statics

**CO3 :** Apply equations of statics to evaluate unknown forces in non-concurrent force systems.

**CO4 :** Locate centroids of plane figures and evaluate its moment of inertia about any axis

**CO5 :** Determine the location of CG, surface areas, volumes and MI of 1D, 2D and 3D bodies

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | | | | | | 2 | | | | | | | |
| | CO2 | 3 | | | | | | | | | | | | |
| | CO3 | 3 | | | | | | | | | | | | |
| | CO4 | 3 | | | | | | | | | | | | |
| | CO5 | 3 | | | | | | | | | | | | |

# Applied Mechanics

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ESCO11 |

**Course Objectives :** This course will enable students :

- To develop students' ability to analyze the problems involving forces, moments with their applications.
- To make students learn the effect of friction on different planes.
- To develop the student's ability to find out the center of gravity and moment of inertia and their applications.
- To make the students learn about kinematics and kinetics and their applications.

## UNIT - I

**FUNDAMENTALS OF MECHANICS** **08 Hrs.**

Introduction to Mechanics, Classification of Engineering Mechanics, Basic terminologies in Mechanics-time, mass, space, length, force, momentum, Continuum, Rigid body, Particle, Characteristics of a force, Scalar and Vector quantities, Fundamentals Laws of Mechanics.

**COPLANAR CONCURRENT FORCES**

Composition of forces, Resolution of forces, General method of composition of forces, Equilibrium of bodies and connected bodies.

## UNIT - II

**COPLANAR NON-CONCURRENT FORCES** **08 Hrs.**

Moment of a force, Varignon's theorem, Couple, resolution of force and a couple, resultant of force systems, equilibrium of coplanar non-concurrent system of forces, application to beam problems- Determination of support reaction for beams subjected to different types of loads (Concentrated loads, UDL, UVL, pure moment and their combinations), introduction to the concepts of determinacy and indeterminacy in components subjected to forces/loads.

## UNIT – III

**CENTROID AND MOMENT OF INERTIA OF PLANE SECTIONS 08 Hrs.**

Importance of centroid and centre of gravity, methods of determining the centroid, locating the centroid of plane lamina from first principles, centroid of composite sections – symmetrical sections -T and I section.

Importance of Moment of Inertia, parallel axis theorem and perpendicular axis theorem, section modulus, radius of gyration, polar moment of inertia, second moment of area (moment of inertia) of plane sections from first principles - rectangle, triangle, circle, moment of inertia of composite sections, Numerical Problems (Only symmetrical sections- T and I section).

## UNIT - IV

**CENTRE OF GRAVITY AND MASS MOMENT OF INERTIA 08 Hrs.**

Centre of gravity concept, centre of gravity from first principles of simple sections, Theorems of Pappus-Guldinus. Mass moment of inertia-determination of mass moment of inertia of rod, rectangular and circular plate from first principles.

**FRICTION**

Frictional force, Laws of friction, angle of friction, angle of repose and cone of friction, Concept of wedges.

## UNIT – V

**DYNAMICS 08 Hrs.**

Basic terms, principles of dynamics, types of motion.

**KINEMATICS**

Introduction, Displacement, speed, velocity, acceleration, acceleration due to gravity, Numerical examples on linear motion.

**PROJECTILES**

Introduction, important definitions, motion of body projected horizontally-derivation and numerical examples.

**KINETICS**

Introduction, approaches- D ‘Alembert’s principle and work-energy method.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | S.S. Bhavikatti | Engineering Mechanics, Eighth Edition, 2021, NEW AGE International Publishers, ISBN 9388818474 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan | Basic Civil Engineering and Engineering Mechanics, third edition, 2015, Laxmi Publications, ISBN: 9789380856674 |
| 2 | Beer F.P. and Johnston E. R | Mechanics for Engineers: Statics and Dynamics, Fourth edition, 1987, McGraw Hill, ISBN: 9780070045842 |
| 3 | Hibbler R. C. | Engineering Mechanics: Principles of Statics and Dynamics, fourteenth edition, 2017, Pearson Press, New Delhi.ISBN:9789332584747 |

## ONLINE RESOURCES :

| | | |
|---|---|---|
| 1 | Prof. K. Ramesh, IIT Madras | NPTEL course on “Engineering Mechanics” |

### Course Outcomes :

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

**CO1 :** Identify system of forces and to solve complex engineering problems by applying principles of engineering, science, and mathematics.

**CO2 :** Apply equations of statics to analyze non concurrent force system and to determine support reactions of beams subjected to various loading types.

**CO3 :** Locate the centroid of laminas and compute the moment of inertia of plane sections using first principles.

**CO4 :** Compute the centroid and the moment of inertia of solids from first principles and apply the concept of friction for a given real world problem.

**CO5 :** Apply the Principles of Kinematics and Kinetics to solve plane motion and connected bodies for the solution of engineering problems.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| COs | CO1 | 3 | | | | | 2 | | | | | | | |
| | CO2 | 3 | | | | | | | | | | | | |
| | CO3 | 3 | | | | | | | | | | | | |
| | CO4 | 3 | | | | | | | | | | | | |
| | CO5 | 3 | | | | | | | | | | | | |

# Introduction to C Programming

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 40 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | PLC5 |

**Course Objectives :** This course will enable students to:

- Elucidate the basic architecture and functionalities of a computer.
- Apply programming constructs of C language to solve the real-world problems.
- Explore user-defined data structures like arrays, structures, and pointers in implementing solutions to problems.
- Design and Develop Solutions to problems using structured programming constructs such as functions and procedures.

## UNIT - I

**INTRODUCTION TO C** **08 Hrs.**

Introduction to computers, input and output devices, designing efficient programs. Introduction to C, Structure of C program, Files used in a C program, Compilers, Compiling and executing C programs, variables, constants, Input/output statements in C.

**Textbook: Chapter 1.1 - 1.9, 2.1 - 2.2, 8.1 - 8.6, 9.1 - 9.14**

## UNIT - II

**DECISION CONTROL AND LOOPING STATEMENTS** **08 Hrs.**

Operators in C, Type conversion and typecasting. Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement.

**Textbook: Chapter 9.15 - 9.16, 10.1 - 10.6**

## UNIT - III

**FUNCTIONS & ARRAY** **08 Hrs.**

**FUNCTIONS:** Introduction using functions, Function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions.

**ARRAYS:** Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions.

**Textbook: Chapter 11.1 - 11.13, 12.1 - 12.6**

## UNIT - IV

**APPLICATIONS OF ARRAYS AND INTRODUCTION TO STRINGS 08 Hrs.**

Two dimensional arrays, operations on two-dimensional arrays, two-dimensional arrays to functions, multidimensional arrays.

Applications of arrays, case study with sorting techniques.

**INTRODUCTION TO STRINGS:** Reading strings, writing strings, summary of functions used to read and write characters.Suppressing input using a Scanset.

**Textbook: Chapter 12.7 - 12.12**

## UNIT - V

**STRINGS, POINTER AND STRUCTURES 08 Hrs.**

**STRINGS:** String taxonomy, operations on strings, Miscellaneous string and character functions, arrays of strings.

**POINTER:** Understanding the Computers Memory, Introduction to Pointers, Declaring Pointer Variables.

**STRUCTURES:** Introduction to structures.

**Textbook: Chapter 13.1 - 13.6, 14.1 - 14.3, 15.1**

## LAB ASSIGNMENTS

| | |
|---|---|
| 1 | C Program to find Mechanical Energy of a particle using E = mgh+1/2 mv2. |
| 2 | C Program to convert Kilometers into Meters and Centimeters. |
| 3 | C Program To Check the Given Character is Lowercase or Uppercase or Special Character. |
| 4 | Program to balance the given Chemical Equation values x, y, p, q of a simple chemical equation of the type: The task is to find the values of constants b1, b2, b3 such that the equation is balanced on both sides and it must be the reduced form. |
| 5 | Implement Matrix multiplication and validate the rules of multiplication |
| 6 | Compute sin(x)/cos(x) using Taylor series approximation. Compare you result with the built-in library function. Print both the results with appropriate inferences. |
| 7 | Sort the given set of N numbers using Bubblesort. |
| 8 | Write functions to implement string operations such as compare, concatenate,string length Convince the parameter passing techniques. |

| | |
|---|---|
| 9 | Implement structures to read, write and compute average-marks and the students scoring above and below the average marks for a class of N students. |
| 10 | Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers. |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Reema Thareja | PROGRAMMING IN C, Third Edition, Oxford University, 2023 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | E. Balaguruswamy | Programming in ANSI C, 9e, Tata McGraw Hill Education. |
| 2 | Brian W. Kernighan and Dennis M. Ritchie | The 'C' Programming Language, Second Edition, Prentice Hall of India, 2015 |

### Course Outcomes :

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

**CO1 :** Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts.

**CO2 :** Apply programming constructs of C language to solve the real world problem.

**CO3 :** Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting.

**CO4 :** Explore user-defined data structures like structures, unions and pointers in implementing solutions.

**CO5 :** Design and Develop Solutions to problems using modular programming constructs using functions.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 2 | | | | | 2 | | | 3 | | | | |
| | **CO2** | | | 2 | | | | | | | | | | |
| | **CO3** | 2 | | 2 | | | | | | | | | | |
| | **CO4** | 2 | | 2 | | | | | | | | | | |
| | **CO5** | | | 2 | | | | | | | | | | |

# Python Programming (Integrated Course)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+2(P) | Credits | : | 4.0 |
| Total Lecture Hours | : | 42 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 28 | Exam Hours | : | 3 |
| Course Type | : | Integrated | Course Code | : | PLC6 |

**Course Objectives :** This course will enable students to:

- Learn the syntax and semantics of the Python programming language.
- Illustrate the process of structuring the data using lists, tuples.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object-Oriented Programming concepts in Python.

## UNIT - I

**INTRODUCTION TO PYTHON** **07 Hrs.**

Features of Python, Character Set, Identifiers, Reserved keywords, Variables and comments in Python, Indentation in Python, Multi-line statements, Quotes in Python, Input-output statements and Import functions: Displaying the output, Reading the Input and Import functions. Operators in Python.

**DATA TYPES AND OPERATIONS :**

**Numbers :** Integer, floating-point and complex number Mathematical Functions, Trigonometric Functions and Random Number Functions. **Strings:** Escape Characters, String Formatting operator and String formatting functions.

## UNIT - II

**FLOW CONTROL** **09 Hrs.**

**Flow Control:** Decision Making Statements- if statement, if..else statement, if..elif.. else statement, nested if statement. Python programs to illustrate the operations on different data types. Match statement, Switch statement.

**Loops:** for loop, for loop with else, while loop and wile loop with else statement. Nested loops. Control statements: break statement, continue statement pass statement. Types of loops: infinite loop, Loops with condition at the top and Loops with condition at the bottom.

## UNIT - III

**LIST, TUPLE & DATA TYPES AND OPERATIONS** **09 Hrs.**

**List:** Definition, creation of list, properties and characteristics of list, operations on list using Built-in List Functions and Built-in-List Methods.

**Tuple:** Definition, Creation of Tuple, characteristic properties of Tuple, Operations on Tuple using Built-in-Functions and Methods. Simple problems solving using python programming language.

**Data Types and Operations: Dictionary:** Definition, Creation of Dictionary, Characteristics of Dictionary. Operations on Dictionary using Built-in-Functions and Methods. Mutable and immutable objects and Data type conversions. Sets: Definition, creation of a set, properties of sets, operations on sets using Built-in –Functions and Methods.

## UNIT - IV

**FUNCTIONS** **09 Hrs.**

**Functions:** Function definition, Function calling Function arguments, default arguments and variable-length arguments. Scope of variables, Anonymous functions (lambda functions) and its uses. Recursive functions. Function without return and with return values. Programming examples on flow control and loops. Built-in Functions: The enum () function. The eval () function.

**Modules and Packages:** Built-in Modules, Creating Modules, import statement, locating modules and namespaces and scope. Packaging in python, date and time modules. Exercise Python Programs.

**Exception Handling:** Built-in Exceptions and Handling Exceptions using try – except, try finally, Exception with arguments and raising an exception.

## UNIT - V

**ELEMENTARY CONCEPTS OF OOPS IN PYTHON** **08 Hrs.**

**Elementary Concepts of Oops in Python:** Classes and objects, features of OOPs, constructors, operator overloading, method overloading, Encapsulation, Inheritances and Polymorphism.

**File Organization:** Definition of file, opening a file: modes and attributes of file object, writing and closing file, reading from a file. File methods, Renaming and deleting a file. Directories. The shutil Module, Walking a Directory Tree, Compressing, Files with the zipfile Module. Example Programs.

## LABORATORY EXPERIMENTS OR PROGRAMS

| | |
|---|---|
| **Aim: Introduce the Python fundamentals, data types, operators and flow control.** | |
| **1.** | Develop a Python program to compute the distance between two given points. (Euclidean distance formula). |
| **2.** | Develop a Python program to find the largest of three given numbers using if-elif statements. |
| **3.** | Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number. |
| **Aim: Demonstration of manipulation of list and functions.** | |
| **4.** | Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.<br>**The first two terms are 0 and 1**<br>**A Fibonacci sequence is the integer sequence of 0, 1, 1, 2, 3, 5, 8....** |
| **5.** | Develop a python to compute the gcd of two given numbers using function with argument and return value. |
| **6.** | Develop a python program to sort the given list using selection sort. |
| **7.** | Develop a python program to find the key elements in a given list using binary search technique. |
| **Aim: Demonstration of Dictionary and strings using string methods.** | |
| **8.** | Develop a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.(without using built-in function) |
| **9.** | Develop a program to convert roman numbers in to integer values using dictionaries. |

| | |
|---|---|
| **10.** | Develop a python program to Check if a given string is binary string or not.<br>[Hint: Input: str = "01010101010"<br>Output: Yes<br>Input: str = "geeks101"<br>Output: No ] |
| **11.** | Develop a python program to check if a string contains any special character.<br>[Hint: Input : Rudra@ Rudra$@Rudra<br>Output : String is not accepted.<br>Input : Rudra Rudra Rudra<br>Output : String is accepted |
| **12.** | Develop a Python program by creating a class called Employee to store the details of Name, Employee_ID, Department and Salary, and implement a method to update salary of employees belonging to a given department. |
| **13.** | Develop Python Program to Create a Class Called as Complex and Implement __add__() Method to Add Two Complex Numbers. Display the Result by Overloading the + Operator. |
| **14.** | Develop a python program utilizing inheritance to calculate the area of a triangle, circle, and rectangle is presented below. The Shape class serves as the base class, defining a common interface for calculating area. Derived classes (Triangle, Circle, and Rectangle) inherit from Shape and implement their specific area calculation methods. |
| **15.** | Write a python program to accept a file name from the user and perform the following operations<br>1. Display the first N line of the file<br>2. Copy to content to another file.<br>3**.** Display the copied file in reversed order. |
| **16** | Develop a python program to generating random quiz files along with key answer file. (Each set must have 10 questions and five different quiz patterns). |

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Jeeva Jose and P.Sojan Lal | Introduction to Computing and Problem Solving with Python.<br>Khanna Book Publishing Co. (P) Ltd, New Delhi. ISBN: 978-93-82609-81-0, 2025. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Y. Daniel Liang | Introduction to Programming using Python, Pearson Higher Education, 1E, online free access, ISBN 13: 978-0-13-274718-9 |
| 2 | Reema Thareja | Python Programming, 3rd Edn., Oxford University Press, July 2025. ISBN-10-9367257651 |
| 3 | Kenneth A. Lambert and Martin Osborne | Fundamentals of Python: First Programs, 2nd Edition, Cenage Publishers, 2017, ISBN: 978-1-337-56009-2 |

### Course Outcomes :

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

**CO1 :** Apply the fundamentals concepts of python programming languages to solve the problems.

**CO2 :** Apply different data types to solve the problems.

**CO3 :** Apply the different flow control, loop and built-in functions and methods to solve the problems.

**CO4 :** Discuss the file organizing and different exception handling mechanisms in python programming.

### Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| COs | CO1 | 3 | 2 | | | | | | | | | | 3 | | |
| | CO2 | 3 | 2 | 2 | | 3 | | | | 3 | | | 3 | | |
| | CO3 | 3 | 2 | 1 | | 3 | | | | 3 | | | 3 | | |
| | CO4 | 3 | 2 | 1 | | 3 | | | | 3 | | | 3 | | |
| | AVG | 3 | 2 | 1 | | 3 | | | | 3 | | | 3 | | |

# Introduction to AI and Applications

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 3(L)+0(T)+0(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 42 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Theory | Course Code | : | ETC13 |

**Course Objectives :** This course will enable students to:

- Introduce basic concepts and techniques of Artificial Intelligence (AI) and Artificial Super Intelligence (ASI).
- Apply informed search techniques for different applications.
- Introduce basic concepts and techniques of Machine Learning (ML).
- Learn knowledge representation mechanism, prompt engineering techniques and writing prompts for creative thinking and creative writing.
- Introduce tends in AI and super intelligence.
- Learn the basics of Robotics and its Engineering applications.

## UNIT - I

**INTRODUCTION TO ARTIFICIAL INTELLIGENCE** **10 Hrs.**

**Introduction to Artificial Intelligence:** Artificial Intelligence, How Does AI Work? Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence.

Types of Artificial Intelligence, Weak AI, Strong AI, Narrow AI, Artificial General Intelligence, Artificial Super Intelligence, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness, Preparing for Super Intelligence: Major Breakthroughs of Narrow AI.

**Artificially Intelligent Machine:** Defining Intelligence, Components of Intelligence, Differences between Human and Machine Intelligence, Agent and Environment.

Fundamentals of Machine Learning, Types of Machine Learning Algorithms. Model-Based and Model-Less Learning.

## UNIT - II

**REGRESSION ANALYSIS IN MACHINE LEARNING** **08 Hrs.**

**Regression Analysis in Machine Learning:** Linear regression (Simple and Multiple) and Polynomial regression, Model Evaluation Metrics in Regression (MMSE, RMSE, R-square, Adjusted R-square), Logistic regression.

**Classification Techniques:** K-Nearest Neighbor algorithm, Decision tress, Metrics used in decision trees (Gini index and Entropy), Random forest, Evaluation metrics used in classification (Confusion matrix: Accuracy, Precision, Recall, F1-score)

## UNIT - III

**CLASSIFICATION TECHNIQUES** **08 Hrs.**

**Classification Techniques :** Naïve Bayes Classification, Artificial Neural Network: Activation functions, Forward propagation and Backward propagation using stochastic gradient descent algorithm, Deep Learning, Machine learning vs Deep learning.

**Clustering :** Partitioning clustering (K-Means clustering), Hierarchical clustering, Density based clustering (DBSCAN), Evaluation metrics in clustering (Inertia and Dunn Index)

## UNIT - IV

**KNOWLEDGE REPRESENTATION** **08 Hrs.**

**Knowledge Representation:** Introduction, Knowledge Representation, Knowledge-Based Agent, Types of Knowledge.

Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work? Prompt Engineering Techniques for ChatGPT, Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, Few-Shot Prompting, and Self-Consistency Prompt.

**Current Trends in Artificial Intelligence:** AI and Ethical Concerns, AI as a Service (AIaaS)

## UNIT - V

**APPLICATIONS OF AI** **08 Hrs.**

**Recent trends in AI:** Algorithmic Game Theory and Computational Social Choice, Neuromorphic Computing.

Robotics, Application of AI in Robotics, Drones Using AI, No Code AI, Low Code AI.

**Applications of AI:** Application of AI in Computer Science, Application of AI in Civil Engineering, Application of AI in Electronics and Telecommunications, Application of AI in Electronics and Electrical Engineering, Application of AI in Electronics and Instrumentation, Application of AI in Mechanical Engineering, Application of AI in Biotechnology, Application of AI in Industrial Engineering and Management

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | Reema Thareja | Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023 |
| 2 | Ajantha Devi Vairamani and Anand Nayyar | Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024 |
| 3 | SASI | "Engineering Intelligence - A VTU Abridged Series", Chiac ASI, 2025 |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | Stuart Russell and Peter Norvig | Artificial Intelligence: A Modern Approach (4th Edition), Pearson Education, 2023 |
| 2 | Elaine Rich, Kevin Knight, and Shivashankar B. Nair | Artificial Intelligence, McGraw Hill Education |
| 3 | Tom Taulli | Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond, Apress, Springer Nature |
| 4 | Nilakshi Jain | Artificial Intelligence: Making A System Intelligent, First Edition, Wiley |

## WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

1. Elements of AI – https://www.elementsofai.com
2. CS50's Introduction to Artificial Intelligence with Python – Harvard https://cs50. harvard.edu/ai/
3. Google Machine Learning Crash Course – https://developers. google. com/ machine-learning/crash-course
4. Learn Prompting (Open-Source Guide) – https://learnprompting.org
5. Google AI – Learn with Google AI https://ai.google/education/
6. Coursera – Machine Learning by Andrew Ng (Stanford University) https://www.coursera.org/ learn/machine-learning
7. OpenAI Prompt Engineering Guide (for ChatGPT) https://platform.openai.com/ docs/guides/gpt-best-practices
8. Prompt Engineering for Developers – DeepLearning.AI + OpenAI https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for developers/
9. Ethics in AI – Google Responsible AI Practices https://ai.google/ responsibilities/ responsible-ai-practices/
10. Google Teachable Machine (Train AI models visually without code) https://teachablemachine.withgoogle.com

## Course Outcomes :

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

**CO1 :** Explain the concepts and types of artificial intelligence and artificial super intelligence

**CO2 :** Illustrate basic machine learning methods for regression and classification.

**CO3 :** Illustrate basic machine learning methods for clustering and neural networks.

**CO4 :** Make use of prompt engineering techniques to interact with generative AI tools.

**CO5 :** Identify real-world applications of AI across different Engineering disciplines.

## Course Articulation Matrix

| | | POs | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **COs** | **CO1** | 2 | 2 | | | | | | | | | | | 2 |
| | **CO2** | 2 | | 2 | | | | | | | | | | 2 |
| | **CO3** | 2 | | 2 | | | | | | | | | | 2 |
| | **CO4** | 2 | 2 | | | | | | | | | | | 2 |
| | **CO5** | 2 | | 2 | | | | | | | | | | 2 |

# ಬಳಕೆ ಕನ್ನಡ Balake Kannada (Kannada for Usage)

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 1(L)+0(T)+0(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 15 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 1 |
| Course Type | : | Theory | Course Code | : | CC03 |

**Course Objectives :** This course will enable students :

- To create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.
- To know about Karnataka state and its language, literature and General information about this state.

## UNIT - I

1. Introduction, Necessity of learning a local language, Methods to learn the Kannada language. **03 Hrs**
2. Easy learning of a Kannada Language: A few tips, Hints for correct and polite conservation, Listening and Speaking Activities, Key to Transcription.
3. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words.

## UNIT - II

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - Possessive forms of nouns, doubtive question and Relative nouns. **03 Hrs**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು - Qualitative, Quantitative and Colour Adjectives, Numerals.
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು - ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ - (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) - Predictive Forms, Locative Case.

## UNIT - III

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - Dative cases and Numerals. **03 Hrs**
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - Ordinal Numerals and Plural markers.
3. ನ್ಯೂನ/ ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು - Defective / Negative verbs and Colour Adjectives.

## UNIT - IV

1. ಅಪ್ಪಣೆ/ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, Encouraging and Urgin words (Imperative words and sentences) **03 Hrs**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative cases and Potential Forms used in General Communication.
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು Helping verbs '*iru* and *iralla*'. Corresponding Future and Negation verbs.
4. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತುಸೂಚಕ ಪ್ರತ್ಯೆಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ Comparative, Relationship, Identification and Negation words.

## UNIT - V

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - Different types of Tense, Time and Verbs. **03 Hrs**
2. -ದ್, -ತ್, -ತು, -ಇತು, -ಆಗಿ, -ಅಲ್ಲ, -ಗ್, -ಕ್, ಇದೆ ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms.
3. ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Vocabulary List. Kannada Words in Conversation.

## TEXT BOOKS :

| | |
|---|---|
| 1 | **ಬಳಕೆ ಕನ್ನಡ** - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.<br>**ಸೂಚನೆ :**<br>ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.<br>ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ ಮತ್ತು ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್‌ಸೈಟ್ ನೋಡುವುದು. |

### Course Outcomes :

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

**CO1 :** To familiarize the necessity of learning of local language for comfortable life.

**CO2 :** To speak, read and write Kannada language as per requirement.

**CO3 :** To communicate (converse) in Kannada language in their daily life with Kannada speakers.

**CO4 :** To Listen and understand the Kannada language properly.

**CO5 :** To speak in polite conservation.

# ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ Samskruthika Kannada

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 1(L)+0(T)+0(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 15 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 1 |
| Course Type | : | Theory | Course Code | : | CC04 |

**Course Objectives :** This course will enable students to:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
- ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

## ಘಟಕ - 1

**ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು** **03 ಗಂಟೆಗಳು**

1. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ – ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
2. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

## ಘಟಕ - 2

**ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ** **03 ಗಂಟೆಗಳು**

1. ವಚನಗಳು – ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಜೇಡರ ದಾಸಿಮಯ್ಯ
2. ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ – ಕನಕದಾಸರು

## ಘಟಕ - 3

**ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ** **03 ಗಂಟೆಗಳು**

1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು

2. ಕುರುಡು ಕಾಂಚಾಣ: ದ.ರಾ. ಬೇಂದ್ರೆ

3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

## ಘಟಕ - 4

**ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ** **03 ಗಂಟೆಗಳು**

1. ಡಾ. ಸರ್ ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್

2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ – ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

## ಘಟಕ – 5

**ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ** **03 ಗಂಟೆಗಳು**

1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ

## TEXT BOOKS :

| | |
|---|---|
| 1 | **ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ** – ಡಾ. ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ<br>ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.<br>**ಸೂಚನೆ :**<br>ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.<br>ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ ಮತ್ತು ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್‌ಸೈಟ್ ನೋಡುವುದು. |

**Course Outcomes :**

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

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ನಂತರ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ:

**CO1 :** ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿರುತ್ತದೆ.

**CO2 :** ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.

**CO3 :** ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿ ಹೆಚ್ಚಾಗುತ್ತದೆ.

**CO4 :** ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನ ಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವ ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.

**CO5 :** ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

# Communication Skills

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 1(L)+1(T)+0(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 15 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 15 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 2 |
| Course Type | : | Theory | Course Code | : | CC08 |

## UNIT - I

**COMMUNICATION SKILLS** **03 Hrs**

Glimpses of Essential English for Engineers (General Overview). Communication Skills: Process, Verbal and Non-Verbal, Proxemics, Chronemics and Barriers. **Writing**: Word Classification – Parts of Speech, Sentence structures.

**Speaking & Listening:** Listening to English Pronunciation – English Phonemes – Intelligible Accent – Speech Organs- Syllable Structures, Stress, Intonation, and Practice.

| | |
|---|---|
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) & Eclectic Approach |
| **Digital Tools** | ALL 44 sounds of English in 75 minutes - https://www.youtube.com/watch?v=QxQUapA-2w4&t=51s.<br>AI-based grammar and writing tools<br>(e.g., Grammarly, ChatGPT, Quillbot) to analyze and classify parts of speech.<br>AI-based pronunciation tools (Google Speech-to-Text) for real-time feedback |
| **Reading Material** | "**The Chimney Sweeper"** by William Blake<br>Martin Luther King Jr's "I Have a Dream" Speech |
| **Assessment Techniques and Tools** | **Role Play**: Formal/informal scenarios, **Group Discussion (GD), Case Studies Analysis**: Identify barriers and suggest solutions, **Mini-Presentation**: Focused on proxemics.<br>Observation Rubric (for body language, tone, time cues), (Sample Rubric, please refer the annexure), Video Recording + Self-evaluation Sheet. |

# UNIT - II

**INTERPERSONAL SKILLS** **03 Hrs**

**Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks- Personal Empowerment, Participating in Group Discussion and Debates, Giving Technical Presentation.

**Reading:** Reading the Interview of an Achiever (Skimming and Scanning) (Case Studies).

**Writing:** Writing a Short Biography of an Achiever Based on given reflections,

**Grammar:** Sentence patterns. **Vocabulary** Development: Idioms and Phrases.

| | |
|---|---|
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) & Eclectic Approach |
| **Digital Tools** | Google Meet / Zoom + AI Transcription- Practice group discussions with live transcription.<br>Grammarly - Highlights grammar issues with explanations.<br>**Oxford Learner's Dictionaries**<br>**(**https://www.oxfordlearnersdictionaries.com/) - Includes etymology, pronunciation, synonyms/antonyms |
| **Assessment Techniques and Tools** | Group discussion performance (listening, turn-taking, clarity)<br>Technical presentations (confidence, structure, clarity)<br>Role plays (relevance, tone, spontaneity) |
| | Case Studies<br>Oral communication rubric (clarity, relevance, tone, confidence, non-verbal cues),<br>**Activity**: Read a short **interview of an achiever** (e.g., A. P. J. Abdul Kalam, Sudha Murthy)<br>**LMS (Learning Management Systems)**: Moodle or Google Classroom for submissions and reflections.<br>**Video Submissions**: Students submit videos of role plays or presentations for asynchronous review. |

## UNIT - III

**ENGLISH FOR EMPLOYABILTY** **03 Hrs**

**Writing:** Formal Letter writing (Enquiry, Order, and Complaint). Tenses – Reported Speech-Voice - Email Etiquettes, Structure, Writing and Responding to Emails. Paragraph Writing (Descriptive, Argumentative, Expository, Short Story, and Narrative), Blog Writing. **Reading**: Proof Reading (Spelling, Punctuation, Grammar). Error Identification Exercises. **Speaking:** Questions & Requests (non-Wh questions and Question tags).

| | |
|---|---|
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) & Eclectic Approach |
| **Digital Tools** | Grammarly – Check grammar, tone, spelling<br>Canva - Free templates to create posters, ads, infographics<br>Adobe Express – Visual storytelling and ad design |
| **Assessment Techniques and Tools** | **Paragraph Writing -** Descriptive, Argumentative, Expository, Short Story, Narrative - Paragraph rubric (structure, logic, vocabulary, grammar)<br>**Writing - Tool**: Digital submission + rubric for content originality, reader engagement, clarity.<br>**Speaking Skills -** Oral assessment rubric (intonation, clarity, accuracy)<br>Email simulator (Google Forms/Canvas/Docs template) |

## UNIT - IV

**ENGLISH IN DIGITAL WORLD** **03 Hrs**

**Writing:** Framing of search terms / keywords in search engines/ Commands for search on open AIs - Tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media - Online communication - Types – pros and cons of online communication. Acceptable online roles and behaviours – Netiquettes - Etiquettes of social media. Problems and opportunities in handling digital resources -Tools to check grammar. **Writing:** Citing information accurately from source material - Plagiarism – Infringement, Importance of academic integrity.

| | |
|---|---|
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) & Eclectic Approach |
| **Digital Tools** | Google Meet - Integrated with Gmail, free for students<br>Google Classroom - Forum, assignments, comments |
| **Assessment Techniques and Tools** | Write a short essay (150–200 words) on the **problems and opportunities.**<br>Evaluation rubric (structure, coherence, grammar).<br>Grammar assessment rubric (before vs after comparison, understanding of corrections). |

## UNIT - V

**APPLYING FOR JOBS** **03 Hrs**

**Listening:** TED Talks. **Speaking:** Mock Interview, Telephone Interviews.

**Reading:** Reading a Job Interview- language used in formal professional settings, formal vs. informal tone, non-verbal communication cues, Statement of Purpose, Company Profile and Completing Comprehension Exercises

**Writing:** Job Applications and Resumes **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

| | |
|---|---|
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) & Eclectic Approach |
| **Digital Tools** | Listening to professional talks, analyzing tone and structure - https://www.ted.com/talks<br>Non-verbal cues in professional reading - https://www.youtube.com/c/Mindsight<br>Grammar AI practice - https://quillbot.com/grammar-check |
| **Assessment Techniques and Tools** | TED Talk worksheet - Listening rubric (comprehension, inference, note-taking), Reading comprehension tests, Resume & Application rubric (content, layout, tone, language), Grammar MCQs / Editing worksheet, Scenario-based MCQs or roleplay, Vocabulary worksheet |

## EXTRA READING :

| | |
|---|---|
| 1 | Kumar, A. R. (2008). *English for engineers and technologists*. Orient BlackSwan. |
| 2 | Raman, M., & Sharma, S. (2015). *Technical communication: Principles and practice* (3rd ed.). Oxford University Press. |
| 3 | Floyd, K., & Cardon, P. W. (2019). *Business and professional communication* (3rd ed.). Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 \| Published: December 23, 2024. |
| 4 | Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 \| Published: September 12, 2024 |
| 5 | Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications. |

## LEARNING RESOURCES :

| | |
|---|---|
| 1 | Oxford Advance Learners Dictionary. |
| 2 | Cambridge English Skills Real Listening and Speaking by Miles Craven. |
| 3 | Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar |

**Course Outcomes :**

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

**CO1 :** Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness.

**CO2 :** Use interpersonal skills in group discussions, presentations, and professional interactions.

**CO3 :** Apply formal writing, email etiquette, and creative content development for employability.

**CO4 :** Communicate effectively in digital platforms, following netiquette and academic integrity.

**CO5 :** Prepare job applications, resumes, and perform confidently in interviews.

# Soft Skills

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 1(L)+0(T)+0(P) | Credits | : | 0 |
| Total Lecture Hours | : | 15 | CIE Marks | : | 100 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 00 |
| Total Practical Hours | : | 00 | Exam Hours | : | -- |
| Course Type | : | NCMC | Course Code | : | CC09 |

## MODULE - I

**SOCIAL SKILLS** **03 Hrs**

**Communication:** Principles of clear and effective exchange of ideas in professional and social contexts.

**Persuasion:** Techniques to influence and convince through logical, emotional, and ethical appeals.

**Self-Awareness:** Identifying personal strengths, weaknesses, opportunities, and challenges (SWOC analysis).

**Active Listening:** Paraphrasing, questioning techniques, and demonstrating attentiveness.

| | |
|---|---|
| **Instructional Design** | Each competency is taught and assessed through guided visualizations, reflections, explainers and hands on activities conducted during sessions build both conceptual understanding and real-world application. |
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach |
| **Experiential Learning Methods** | To embed skills, participants get hands-on through:<br>Guided reflections and explainers to connect concepts with relatable real-life situations<br>Guided visualization to prompt reflection and self-discovery<br>Role-plays and activities to practice behaviours in context<br>Peer discussions to gain diverse perspectives. |

| | |
|---|---|
| **Assessment Methods** | **Formative:** Role-plays, activities, group discussions, peer feedback.<br>**Summative:** Presentations, written reflections, problem-solving exercises. |

## MODULE - II

**EMOTIONAL SKILLS - I** **03 Hrs**

**Emotional Intelligence (EI):** Recognizing and managing emotions, empathy, relationship management, and conflict resolution.

**Stress Management:** Identifying stress triggers, relaxation techniques, work-life balance strategies, and mindfulness practices.

**Time Management:** Prioritization (Eisenhower Matrix), setting SMART goals, avoiding procrastination, and effective scheduling.

**Adaptability & Resilience:** Handling change, bouncing back from setbacks, and developing a growth mindset.

| | |
|---|---|
| **Instructional Design** | Each competency is taught and assessed through guided visualizations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application. |
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach |
| **Experiential Learning Methods** | To embed skills, participants get hands-on through:<br>Guided reflections and explainers to connect concepts with relatable real-life situations<br>Guided visualization to prompt reflection and self-discovery<br>Role-plays and activities to practice behaviours in context<br>Peer discussions to gain diverse perspectives. |
| **Assessment Methods** | **Formative:** Role-plays, activities, group discussions, peer feedback.<br>**Summative:** Presentations, written reflections, problem-solving exercises. |

## MODULE - III

**EMOTIONAL SKILLS - II** **03 Hrs**

**Ambition & Goal Setting:** Defining personal and professional aspirations, creating SMART goals, and aligning actions with long-term vision.

**Sympathy & Empathy:** Understanding emotional perspectives, differentiating between the two, and applying them in workplace and social interactions.

**Creativity & Innovation:** Generating original ideas, problem-solving, and applying creative thinking techniques (mind-mapping, SCAMPER).

| | |
|---|---|
| **Instructional Design** | Each competency is taught and assessed through guided visualizations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application. |
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach |
| **Experiential Learning Methods** | To embed skills, participants get hands-on through:<br>Guided reflections and explainers to connect concepts with relatable real-life situations.<br>Guided visualization to prompt reflection and self-discovery<br>Role-plays and activities to practice behaviours in context<br>Peer discussions to gain diverse perspectives. |
| **Assessment Methods** | **Formative:** Role-plays, activities, group discussions, peer feedback.<br>**Summative:** Presentations, written reflections, problem-solving exercises. |

## MODULE - IV

**PROFESSIONAL SKILLS - I** **03 Hrs**

**Problem Solving:** Identifying root causes, analysing options, and implementing solutions using methods like 5 Whys and Fishbone Diagram.

**Discipline:** Building consistency, accountability, and professional habits.

**Time Management:** Prioritizing tasks (Eisenhower Matrix), scheduling, avoiding procrastination.

| | |
|---|---|
| **Instructional Design** | Each competency is taught and assessed through guided visualizations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application. |
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach |
| **Experiential Learning Methods** | To embed skills, participants get hands-on through:<br>Guided reflections and explainers to connect concepts with relatable real-life situations<br>Guided visualization to prompt reflection and self-discovery<br>Role-plays and activities to practice behaviours in context<br>Peer discussions to gain diverse perspectives. |
| **Assessment Methods** | **Formative:** Role-plays, activities, group discussions, peer feedback.<br>**Summative:** Presentations, written reflections, problem-solving exercises. |

## MODULE - V

**PROFESSIONAL SKILLS - II** **03 Hrs**

**Collaboration & Teamwork:** Working effectively in diverse teams, fostering trust, and achieving shared goals.

**Negotiation & Conflict Resolution:** Strategies to resolve differences and reach win–win outcomes.

**Critical Thinking:** The ability to analyze, evaluate, and synthesize information to make well-reasoned decisions.

| | |
|---|---|
| **Instructional Design** | Each competency is taught and assessed through guided visualizations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application. |
| **Teaching Methodology** | TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach |

| | |
|---|---|
| **Experiential Learning Methods** | To embed skills, participants get hands-on through:<br>Guided reflections and explainers to connect concepts with relatable real-life situations<br>Guided visualization to prompt reflection and self-discovery<br>Role-plays and activities to practice behaviours in context<br>Peer discussions to gain diverse perspectives. |
| **Assessment Methods** | **Formative:** Role-plays, activities, group discussions, peer feedback.<br>**Summative:** Presentations, written reflections, problem-solving exercises. |

## EXTRA READING :

| | |
|---|---|
| 1 | Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 \| Published: December 23, 2024 |
| 2 | Soft Skills, 1e, By Soma Mahesh Kumar © 2024 \| Published: June 8, 2023 |
| 3 | Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 \| Published: September 12, 2024 |
| 4 | Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications |

## LEARNING RESOURCES :

| | |
|---|---|
| 1 | Oxford Advance Learners Dictionary. |
| 2 | Cambridge English Skills Real Listening and Speaking by Miles Craven. |
| 3 | Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar |

**Course Outcomes :**

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

**CO1 :** Apply social skils for clear communication, persuasion, self-awareness, and active listening.

**CO2 :** Use emotional skills to build confidence, manage stress, and adapt to change.

**CO3 :** Set ambitious goals, practice empathy, and apply creativity for problem-solving.

**CO4 :** Demonstrate discipline, time management, and structured problem-solving.

**CO5 :** Work in teams, negotiate, resolve conflicts, and think critically.

# Indian Constitution and Engineering Ethics

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 1(L)+0(T)+0(P) | Credits | : | 0 |
| Total Lecture Hours | : | 15 | CIE Marks | : | 100 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 00 |
| Total Practical Hours | : | 00 | Exam Hours | : | -- |
| Course Type | : | NCMC | Course Code | : | CC10 |

**Course Objectives :** This course will enable students :

- To know about the basic structure of Indian Constitution.
- To know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.
- To know about our Union Government, political structure & codes, procedures.
- To know the State Executive & Elections system of India.
- To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

## UNIT - I

**INTRODUCTION TO INDIAN CONSTITUTION** **03 Hrs.**

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of Indian Constitution.

## UNIT - II

**FR's, FD's AND DPSP's** **03 Hrs.**

Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

## UNIT - III

**UNION EXECUTIVE** **03 Hrs.**

Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

## UNIT - IV

**STATE EXECUTIVE & ELECTIONS, AMENDMENTS AND EMERGENCY PROVISIONS** **03 Hrs.**

State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions.

## UNIT - V

**PROFESSIONAL ETHICS** **03 Hrs.**

Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

## TEXT BOOKS :

| | |
|---|---|
| 1 | **"Constitution of India"** (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru - 2022. |
| 2 | **"Engineering Ethics",** M. Govindarajan, S. Natarajan, V.S. Senthilkumar, Prentice –Hall, 2004. |

## REFERENCE BOOKS :

| | |
|---|---|
| 1 | "**Samvidhana Odu"** - for Students & Youths by Justice H N Nagamohan Dhas, Sahayana, kerekon. |
| 2 | **"Constitution of India, Professional Ethics and Human Rights"** by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition - 2019. |
| 3 | **"Introduction to the Constitution of India",** (Students Edition.) by Durga Das Basu (DD Basu): Prentice –Hall, 2008. |
| 4 | **"The Constitution of India"** by Merunandan K B : published by Merugu Publication, Second Edition, Bengaluru. |

**Course Outcomes :**

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

**CO1 :** Analyse the basic structure of Indian Constitution.

**CO2 :** Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.

**CO3 :** Know about our Union Government, political structure & codes, procedures.

**CO4 :** Understand our State Executive & Elections system of India.

**CO5 :** Remember the Amendments and Emergency Provisions, other important provisions given by the constitution.

# Computer Aided Engineering Drawing for Civil Engineering Stream

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(L)+0(T)+2(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 52 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Practical | Course Code | : | CAEDC |

**Course Objectives :** This course will enable students :

- To expose the students to standards and conventions followed in preparation of engineering drawings.
- To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
- Develop the ability of conveying the engineering information through drawings.
- To make them understand the relevance of engineering drawings to different engineering domains.
- To expose them to Computer aided drafting package and generation of computer assisted drawings.

## UNIT - I

**INTRODUCTION TO COMPUTER AIDED DRAWING** **14 Hrs**

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigationaltools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing sheet size and scale of a drawing, Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity. Dimensioning,line conventions, material conventions.

**ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANES**

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, (No mid point problems).

***Application problems on Projection of Lines ( For CIE only)***

**PROJECTIONS OF PLANE SURFACES**

Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes indifferent positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP)

## UNIT - II

**PROJECTIONS OF SOLIDS** **12 Hrs**

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP).

**PROJECTIONS OF FRUSTUM OF CONE AND PYRAMIDS**

***(For practice only, not for CIE and SEE)***

## UNIT - III

**DEVELOPMENT OF LATERAL SURFACES OF SOLIDS** **10 Hrs**

Introduction to section planes and sectional views, Development of lateral surfaces ofright regular prisms, cylinders, pyramids, cones resting with base on HP only, Development of lateral surfaces of their frustums and truncations.

Application problems on development of lateral surfaces like funnels and trays

***(For CIE only).***

## UNIT - IV

**ISOMETRIC PROJECTION** **10 Hrs**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids.

## UNIT - V

**CIVIL DRAWING** **06 Hrs**

**(For CIE Only)**

**Free hand Sketching:** Free hand Roads, Buildings, Hand tools & Furniture's etc.

**Materials representation:** Conventions used to represent materials.

**Orthographic and Isometric Drawing Transformations:** Conversion of simple Isometric drawings to Orthographic views of simple objects, Conversion of simple Orthographic views to Isometric projection of simple objects.

**Basic Building Drawing:** Like, Architectural floor plan, Drafting a 2D floor plan for a simple single-storey residential / commercial building, basic foundation drawing.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K.R. Gopalakrishna & Sudhir Gopalakrishna | A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017. |
| 2 | N.D. Bhatt & V.M. Panchal | Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. N. Lal and T. Madhusudhan | Engineering Visualisation, Engage Learning India Pvt. Ltd.; First Edition, 2022. |
| 2 | P.J. Shah | Computer Aided Engineering Drawing, S. Chand Publishing, 2021. |
| 3 | V.B. Sikka | A Course in Civil Engineering Drawing, 11th Edition, S. K. Kataria & Sons, reprint 2024. |

**Course Outcomes :**

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

**CO1 :** Draw orthographic projections of Lines and Planes according to the

constraints of the problem.

**CO2 :** Draw orthographic projections of solids both in conventional way and using modern engineering tool according to the constraints of the problem.

**CO3 :** Develop the lateral surfaces of the objects both in conventional way and using modern engineering tool.

**CO4 :** Draw the isometric projection of combination of solids both in conventional way and using modern engineering tool.

**CO5 :** Demonstrate the ability to convert between orthographic and isometric views of simple objects. Also, draw basic 2D structural drawings such as floor plans and foundation layouts.

## Course Articulation Matrix

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **CO1** | 3 | 1 | | | 2 | | | | | 2 | | |
| **CO2** | 3 | | | | 2 | | | | | 2 | | |
| **CO3** | 3 | 1 | | | 2 | | | | | 2 | | |
| **CO4** | 2 | 1 | | | 2 | | | | | 2 | | |
| **CO5** | 3 | | | | 2 | | | | | 2 | | |

# Computer Aided Engineering Drawing for CSE Stream

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(L)+0(T)+2(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 52 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Practical | Course Code | : | CAEDS |

**Course Objectives :** This course will enable students :

- To expose the students to standards and conventions followed in preparation of engineering drawings.
- To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
- Develop the ability of conveying the engineering information through drawings.
- To make them understand the relevance of engineering drawings to different engineering domains.
- To expose them to Computer aided drafting package and generation of computer assisted drawings.

## UNIT - I

**INTRODUCTION TO COMPUTER AIDED DRAWING** **14 Hrs**

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigationaltools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing sheet size and scale of a drawing, Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity. Dimensioning,line conventions, material conventions.

**ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANES**

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, (No mid point problems).

***Application problems on Projection of Lines ( For CIE only)***

**PROJECTIONS OF PLANE SURFACES**

Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes in different positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP)

## UNIT - II

**PROJECTIONS OF SOLIDS** **12 Hrs**

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP).

**PROJECTIONS OF FRUSTUM OF CONE AND PYRAMIDS**

***(For practice only, not for CIE and SEE)***

## UNIT - III

**DEVELOPMENT OF LATERAL SURFACES OF SOLIDS** **10 Hrs**

Introduction to section planes and sectional views, Development of lateral surfaces of right regular prisms, cylinders, pyramids, cones resting with base on HP only, Development of lateral surfaces of their frustums and truncations.

Application problems on development of lateral surfaces like funnels and trays

***(For CIE only).***

## UNIT - IV

**ISOMETRIC PROJECTION** **10 Hrs**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids.

## UNIT - V

**COMPUTER NET WORKING DRAWING (For CIE Only)** **06 Hrs**

**2D Network Drawings with wired and wireless:**

Typical Computer network, Simple WAN network, Simple LAN network, Simple Star network, Simple wireless network, Internet network

**Gate Circuits:** AND gate stimulation circuit, OR gate stimulation circuit, NOT gate stimulation circuit.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K.R. Gopalakrishna & Sudhir Gopalakrishna | A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017. |

| | | |
|---|---|---|
| 2 | N.D. Bhatt & V.M. Panchal | Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. N. Lal and T. Madhusudhan | Engineering Visualisation, Engage Learning India Pvt. Ltd.; First Edition, 2022. |
| 2 | P.J. Shah | Computer Aided Engineering Drawing, S. Chand Publishing, 2021. |
| 3 | M.S. Sukhija and T.K. Nagsarkar | Circuits and Networks: Analysis Design and Synthesis, Oxford University press, Second Edition 2016. |

### Course Outcomes :

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

**CO1 :** Draw orthographic projections of Lines and Planes according to the constraints of the problem.

**CO2 :** Draw orthographic projections of solids both in conventional way and using modern engineering tool according to the constraints of the problem.

**CO3 :** Develop the lateral surfaces of the objects both in conventional way and using modern engineering tool.

**CO4 :** Draw the isometric projection of combination of solids both in conventional way and using modern engineering tool.

**CO5 :** Interpret basic 2D network diagram and digital logic gate circuits understanding various network topologies.

### Course Articulation Matrix

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO2 | 3 | | | | 2 | | | | | 2 | | |
| CO3 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO4 | 2 | 1 | | | 2 | | | | | 2 | | |
| CO5 | 3 | | | | 2 | | | | | 2 | | |

# Computer Aided Engineering Drawing for Mechanical Engineering Stream

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(L)+0(T)+2(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 52 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Practical | Course Code | : | CAEDM |

**Course Objectives :** This course will enable students :

- To expose the students to standards and conventions followed in preparation of engineering drawings.
- To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
- Develop the ability of conveying the engineering information through drawings.
- To make them understand the relevance of engineering drawings to different engineering domains.
- To expose them to Computer aided drafting package and generation of computer assisted drawings.

## UNIT - I

**INTRODUCTION TO COMPUTER AIDED DRAWING** **14 Hrs**

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigationaltools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing sheet size and scale of a drawing, Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity. Dimensioning,line conventions, material conventions.

**ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANES**

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, (No mid point problems).

***Application problems on Projection of Lines ( For CIE only)***

**PROJECTIONS OF PLANE SURFACES**

Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes in different positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP)

## UNIT - II

**PROJECTIONS OF SOLIDS** **12 Hrs**

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP).

**PROJECTIONS OF FRUSTUM OF CONE AND PYRAMIDS**

***(For practice only, not for CIE and SEE)***

## UNIT - III

**DEVELOPMENT OF LATERAL SURFACES OF SOLIDS** **10 Hrs**

Introduction to section planes and sectional views, Development of lateral surfaces of right regular prisms, cylinders, pyramids, cones resting with base on HP only, Development of lateral surfaces of their frustums and truncations.

Application problems on development of lateral surfaces like funnels and trays

***(For CIE only).***

## UNIT - IV

**ISOMETRIC PROJECTION** **10 Hrs**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids.

## UNIT - V

**MULTIDISCIPLINARY APPLICATIONS & PRACTICE (For CIE Only) 06 Hrs**

**Drawing Simple Mechanisms;** Four bar mechanism, Engine mechanism, Gear trains.

**Materials representations:** Conventions used to represent materials.

**Orthographic and Isometric Drawing Transformations**: Conversion of simple Isometric drawings to Orthographic views of simple objects, Conversion of simple Orthographic views to Isometric projection of simple objects.

**Gate Circuits:** AND gate stimulation circuit, OR gate stimulation circuit, NOT gate stimulation circuit.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K.R. Gopalakrishna & Sudhir Gopalakrishna | A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017. |
| 2 | N.D. Bhatt & V.M. Panchal | Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. N. Lal and T. Madhusudhan | Engineering Visualisation, Engage Learning India Pvt. Ltd.; First Edition, 2022. |
| 2 | P.J. Shah | Computer Aided Engineering Drawing, S. Chand Publishing, 2021. |
| 3 | R.S. Khurmi and J.K. Gupta | Theory of Machines, R.S. Khurmi and J.K. Gupta, S. Chand & Company Ltd., 14th Edition, 2005 |

### Course Outcomes :

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

**CO1 :** Draw orthographic projections of Lines and Planes according to the constraints of the problem.

**CO2 :** Draw orthographic projections of solids both in conventional way and using modern engineering tool according to the constraints of the problem.

**CO3 :** Develop the lateral surfaces of the objects both in conventional way and using modern engineering tool.

**CO4 :** Draw the isometric projection of combination of solids both in conventional way and using modern engineering tool.

**CO5 :** Identify the interdisciplinary engineering components or systems through its graphical representation.

### Course Articulation Matrix

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO2 | 3 | | | | 2 | | | | | 2 | | |
| CO3 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO4 | 2 | 1 | | | 2 | | | | | 2 | | |
| CO5 | 3 | | | | 2 | | | | | 2 | | |

# Computer Aided Engineering Drawing for EEE Branch

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(L)+0(T)+2(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 52 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Practical | Course Code | : | CAEDEE |

**Course Objectives :** This course will enable students :

- To expose the students to standards and conventions followed in preparation of engineering drawings.
- To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
- Develop the ability of conveying the engineering information through drawings.
- To make them understand the relevance of engineering drawings to different engineering domains.
- To expose them to Computer aided drafting package and generation of computer assisted drawings.

## UNIT - I

**INTRODUCTION TO COMPUTER AIDED DRAWING** **14 Hrs**

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigationaltools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing sheet size and scale of a drawing, Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity. Dimensioning,line conventions, material conventions.

**ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANES**

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, (No mid point problems).

***Application problems on Projection of Lines ( For CIE only)***

**PROJECTIONS OF PLANE SURFACES**

Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes indifferent positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP)

## UNIT - II

**PROJECTIONS OF SOLIDS** **12 Hrs**

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP).

**PROJECTIONS OF FRUSTUM OF CONE AND PYRAMIDS**

***(For practice only, not for CIE and SEE)***

## UNIT - III

**DEVELOPMENT OF LATERAL SURFACES OF SOLIDS** **10 Hrs**

Introduction to section planes and sectional views, Development of lateral surfaces ofright regular prisms, cylinders, pyramids, cones resting with base on HP only, Development of lateral surfaces of their frustums and truncations.

Application problems on development of lateral surfaces like funnels and trays

***(For CIE only).***

## UNIT - IV

**ISOMETRIC PROJECTION** **10 Hrs**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids.

## UNIT - V

**ELECTRICAL DRAWING (For CIE Only)** **06 Hrs**

2D drawing of switches, sockets, panels, junction boxes, antenna

**Electrical component symbols and Circuits:** Electrical Circuit Symbols

**Electric Wiring and lighting diagrams;** Like, Call bell system, Two-way control of Lamp, Current sensitive circuit.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K.R. Gopalakrishna & Sudhir Gopalakrishna | A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017. |
| 2 | N.D. Bhatt & V.M. Panchal | Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. N. Lal and T. Madhusudhan | Engineering Visualisation, Engage Learning India Pvt. Ltd.; First Edition, 2022. |
| 2 | P.J. Shah | Computer Aided Engineering Drawing, S. Chand Publishing, 2021. |
| 3 | Bhattacharya S.K. | Electrical Engineering Drawing, New Age International Publishers, Second edition 1998, reprint 2005. |

### Course Outcomes :

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

**CO1 :** Draw orthographic projections of Lines and Planes according to the constraints of the problem.

**CO2 :** Draw orthographic projections of solids both in conventional way and using modern engineering tool according to the constraints of the problem.

**CO3 :** Develop the lateral surfaces of the objects both in conventional way and using modern engineering tool.

**CO4 :** Draw the isometric projection of combination of solids both in conventional way and using modern engineering tool.

**CO5 :** Identify the electrical components or circuits through graphical representation.

### Course Articulation Matrix

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO2 | 3 | | | | 2 | | | | | 2 | | |
| CO3 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO4 | 2 | 1 | | | 2 | | | | | 2 | | |
| CO5 | 3 | | | | 2 | | | | | 2 | | |

# Computer Aided Engineering Drawing for EC, EI and ET Branches

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(L)+0(T)+2(P) | Credits | : | 3.0 |
| Total Lecture Hours | : | 52 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 3 |
| Course Type | : | Practical | Course Code | : | CAEDEC |

**Course Objectives :** This course will enable students :

- To expose the students to standards and conventions followed in preparation of engineering drawings.
- To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
- Develop the ability of conveying the engineering information through drawings.
- To make them understand the relevance of engineering drawings to different engineering domains.
- To expose them to Computer aided drafting package and generation of computer assisted drawings.

## UNIT - I

**INTRODUCTION TO COMPUTER AIDED DRAWING** **14 Hrs**

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigationaltools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing sheet size and scale of a drawing, Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity. Dimensioning,line conventions, material conventions.

**ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANES**

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, (No mid point problems).

***Application problems on Projection of Lines ( For CIE only)***

**PROJECTIONS OF PLANE SURFACES**

Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes indifferent positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP)

## UNIT - II

**PROJECTIONS OF SOLIDS** **12 Hrs**

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP).

**PROJECTIONS OF FRUSTUM OF CONE AND PYRAMIDS**

***(For practice only, not for CIE and SEE)***

## UNIT - III

**DEVELOPMENT OF LATERAL SURFACES OF SOLIDS** **10 Hrs**

Introduction to section planes and sectional views, Development of lateral surfaces ofright regular prisms, cylinders, pyramids, cones resting with base on HP only, Development of lateral surfaces of their frustums and truncations.

Application problems on development of lateral surfaces like funnels and trays

***(For CIE only).***

## UNIT - IV

**ISOMETRIC PROJECTION** **10 Hrs**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids.

## UNIT - V

**ELECTRONICS COMPONENTS VISUALIZATION (For CIE Only)** **06 Hrs**

**Electronics component symbols and Circuits:** Basic electronic components symbols, Transistor as a switch, Zener regulator.

**Electronic Components Visualization**: Optical fiber cable with core and cladding, photonic crystal fibers, Antenna: Single element patch antenna, antenna array.

**Gate Circuits:** AND gate stimulation circuit, OR gate stimulation circuit, NOT gate stimulation Circuit.

## TEXT BOOKS :

| | | |
|---|---|---|
| 1 | K.R. Gopalakrishna & Sudhir Gopalakrishna | A Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017. |
| 2 | N.D. Bhatt & V.M. Panchal | Engineering Drawing: Plane and Solid Geometry, 53rd Edition, Charotar Publishing House Pvt. Limited, 2023. |

## REFERENCE BOOKS :

| | | |
|---|---|---|
| 1 | S. N. Lal and T. Madhusudhan | Engineering Visualisation, Engage Learning India Pvt. Ltd.; First Edition, 2022. |
| 2 | P.J. Shah | Computer Aided Engineering Drawing, S. Chand Publishing, 2021. |
| 3 | Robert L. Boylestad and Louis Nashelsky | Electronic Devices and Circuit Theory, Pearson, 14th edition, 2023 |

### Course Outcomes :

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

**CO1 :** Draw orthographic projections of Lines and Planes according to the constraints of the problem.

**CO2 :** Draw orthographic projections of solids both in conventional way and using modern engineering tool according to the constraints of the problem.

**CO3 :** Develop the lateral surfaces of the objects both in conventional way and using modern engineering tool.

**CO4 :** Draw the isometric projection of combination of solids both in conventional way and using modern engineering tool.

**CO5 :** Identify electronics components or circuits through graphical representation.

### Course Articulation Matrix

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO2 | 3 | | | | 2 | | | | | 2 | | |
| CO3 | 3 | 1 | | | 2 | | | | | 2 | | |
| CO4 | 2 | 1 | | | 2 | | | | | 2 | | |
| CO5 | 3 | | | | 2 | | | | | 2 | | |

# Innovation and Design Thinking Laboratory

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(P) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 26 | Exam Hours | : | 2 |
| Course Type | : | Practical | Course Code | : | SDCxx1 |

**Course Objectives :** This course will enable students :

- The Design Thinking Lab (DTL) is to be carried out by a team of four students.
- Each student in a team must contribute equally in the tasks mentioned below.
- Each group must select a theme that will provide solutions to the challenges of societal concern. Normally three to four themes would be identified by the department.
- The five stages specified will be evaluated in three phases.
- The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee.

## UNIT - I

### EMPATHY STAGE – UNDERSTANDING THE USER

**Objective:** Develop skills to observe, engage, and immerse into the users' experiences.

**Topics Covered:**

- Introduction to empathy in design thinking
- User-centered design principles
- Role of empathy in innovation
- Techniques of empathy research:
    - User interviews (structured, semi-structured, probing)
    - Shadowing and observations
    - Contextual inquiry
    - Probes (cultural probes, diary studies, role-play)
- Capturing insights from observations

**Practical Activities:**

- Conduct field visits and user interviews
- Use empathy probes (photo diaries, self-reporting tools)
- Record and map observations in a journal

**Expected Outcome:** Students learn to identify latent needs, emotions, and motivations of users.

## UNIT - II

### DEFINE STAGE – DEVELOPING A POINT OF VIEW

**Objective:** Frame the right problem statement from the gathered data.

**Topics Covered:**

- Synthesizing research findings
- Empathy mapping (say, think, do, feel framework)
- Identifying user needs and insights
- Crafting problem statements using “Point of View (POV)”
- Converting broad challenges into actionable problem definitions

**Practical Activities:**

- Create empathy maps from interview data
- Group discussion on hidden user needs
- Write multiple POV statements and refine them

**Expected Outcome:** Students articulate a clear and actionable problem definition.

## UNIT - III

### IDEATE STAGE – GENERATING SOLUTIONS

**Objective:** Encourage divergent and convergent thinking for idea generation.
**Topics Covered:**

- Principles of ideation: defer judgment, encourage wild ideas, build on others’ ideas
- Brainstorming techniques:
    - Classic brainstorming
- Criteria for idea selection and convergence

**Practical Activities:**

- Conduct group brainstorming sessions
- Use clustering and voting techniques to prioritize ideas
- Develop idea portfolios (quick sketches or concept notes)

**Expected Outcome:** Students generate a large volume of ideas and shortlist potential solutions.

## UNIT - IV

### PROTOTYPE STAGE – CONSTRUCTING REPRESENTATIONS

**Objective:** Make ideas tangible and testable.

**Topics Covered:**

- Importance of prototyping in design thinking
- Types of prototypes: low-fidelity vs high-fidelity
- Prototyping techniques: paper prototypes, role play, storyboarding, mock-ups, 3D models, digital wireframes
- Rapid prototyping mindset (fail fast, learn fast)

**Practical Activities:**

- Build low-fidelity prototypes of selected ideas
- Storyboard user interaction scenarios
- Present prototypes for peer review

**Expected Outcome:** Students learn to communicate ideas effectively through tangible models.

## UNIT - V

### TEST STAGE – GETTING FEEDBACK

**Objective:** Validate ideas and identify improvements.

**Topics Covered:**

- Testing as a co-creation process
- Methods of testing: usability testing, A/B testing, role play with users, think-aloud protocols

- Capturing user feedback: what works, what doesn't, what could be improved
- Iterating based on feedback

**Practical Activities:**

- Conduct usability testing with real users or peers
- Record user reactions and feedback
- Refine prototypes based on test results

**Expected Outcome:** Students develop skills to iterate designs using constructive user feedback.

**Course Outcomes :**

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

**CO1 :** Identify different modes of thinking to understand the problem instead of finding answers/solutions for questions/problems.

**CO2 :** Acquire abductive reasoning to find new problems.

**CO3 :** Apply the concepts of design thinking concepts to develop a solution to the problem.

**Course Articulation Matrix**

| | | POs | | | | | | | | | | | PSOs | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** | **4** |
| **COs** | **CO1** | 3 | 3 | | | | | | 3 | 2 | | | 3 | | | 3 |
| | **CO2** | 3 | 2 | 2 | | | | | 2 | 2 | | | 3 | | | 3 |
| | **CO3** | 3 | 2 | 2 | 2 | | | | 2 | 2 | | | 3 | | | 3 |

# Interdisciplinary Project-Based Learning

| | | | | | |
|---|---|---|---|---|---|
| Contact Hours/ Week | : | 2(S) | Credits | : | 1.0 |
| Total Lecture Hours | : | 00 | CIE Marks | : | 50 |
| Total Tutorial Hours | : | 00 | SEE Marks | : | 50 |
| Total Practical Hours | : | 00 | Exam Hours | : | 2 |
| Course Type | : | AEC | Course Code | : | SDC2 |

For the course ***Interdisciplinary Project***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.

# STUDENTS INDUCTION PROGRAM (SIP) (3 WEEKS)

Purpose of the *Induction Program* is to help new students to adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self-exploration.

The term *induction* is generally used to describe the whole process whereby the incumbents adjust to or acclimatize to their new roles and environment. In other words, it is a well-planned event to educate the new entrants about the environment in a particular institution, and connect them with the people in it.

Induction Program engages with the new students as soon as they come into the institution; regular classes start only after that. At the start of the induction, the incumbents learn about the institutional policies, processes, practices, culture and values, and their mentor groups are formed. Then the different activities start, including those which are daily.

List of activities:

- Physical Activity
- Creative Arts and Culture
- Mentoring & Universal Human Values
- Familiarization with College, Dept./Branch
- Literary Activity
- Proficiency Modules
- Lectures & Workshops by Eminent People
- Visits in Local Area
- Extra-Curricular Activities in College
- Feedback and Report on the Program

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. These are included under Proficiency Modules.

There will be a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

# AICTE ACTIVITY POINTS

Apart from technical knowledge and skills to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. In order to match these multifarious requirements, AICTE has created a unique mechanism of awarding Activity Points over and above the academic grades.

Following suggestive activities as Long Term Goals may be carried out by students in teams:

- Prepare and implement plan to create local job opportunities.
- Prepare and implement plan to improve education quality in village.
- Prepare an actionable DPR for doubling the village Income.
- Developing Sustainable Water Management System.
- Prepare and improve a plan to improve health parameters of villagers.
- Developing and implementing of Low-Cost Sanitation facilities.
- Prepare and implement plan to promote Local Tourism through Innovative Approaches.
- Implement/Develop Technology solutions which will improve quality of life.
- Prepare and implement solution for energy conservation.
- Prepare and implement plan to develop skills of village youth and provide employment.
- Develop localized techniques for reduction in construction Cost.
- Prepare and implement plan of sustainable growth of village.
- Setting of Information imparting club for women leading to contribution in social and economic issues.
- Developing and managing efficient garbage disposable system.
- Contribution to any national level initiative of Government of India. For example Digital India / Skill India / Swachh Bharat Internship etc.

A student has to earn 100 points (75 points for lateral entry students).

The activities can be spread over entire duration of the programme and it will be reflected in the student's 8$^{th}$ semester Grade Card. It shall not be considered for computation of SGPA/CGPA and for vertical progression. The

total duration of the activities for entire programme is 400 hours for regular students and 300 hours for lateral entry students.

AICTE Activity Points Implementation and Monitoring Committee has been constituted under the Chairmanship of Principal and NSS Coordinator as convener, and Dean Academic, Dean Student Welfare, Chief Warden, NCC Coordinator and Two Senior Professors as members. This Committee shall arrange for logistics and material support wherever necessary and review the progress at the end of each Semester.

**Procedure:**

1. Students can take-up listed activities individually or in a group.
2. Proctors shall monitor the progress of students' work.
3. They can work on daily basis/ weekends/ or in one shot, continuously for 300 hours to earn 100 points. The schedule is at the convenience of group of students.
4. For every **FOUR** hours of work students will get **ONE** Activity Point.
5. Students shall submit a report and photographs related to activities carried out to the proctor
6. Students shall maintain a “Activity Logbook”
7. Students shall register to "Activity Points" during VIII Semester
8. The work done by students will be reviewed by Department Seminar Evaluation Committee during VIII Semester.
9. Break-up of CIE marks for activity points:

| | |
|---|---|
| Evaluation by the Proctor | 20 marks |
| Evaluation by DSEC | |
| (i) Report | 30 marks |
| (ii) Presentation | 30 marks |
| (iii) Outcome | 20 marks |
| **Total** | **100 marks** |

10. No SEE for Activity Points.
11. Students will be awarded either NP or PP grade based on their performance.
12. Students will be awarded degree only on earning PP grade in the Activity Points.

# PROGRAM OUTCOMES

**Engineering Graduates will be able to:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Our Motto

# "WORK IS WORSHIP"

## Vision

To develop thoughtful and creative young minds in a learning environment of high academic ambience by synergising spiritual values and technological competence.

## Mission

1. To continuously strive for the total development of students by educating them in state-of-the-art-technologies and managerial competencies providing best in class learning experience with emphasis on skills, values and learning outcomes and helping them imbibe professional ethics and societal commitment.
2. To create research ambience that promotes interdisciplinary research catering to the needs of industry and society.
3. To collaborate with premier academic and research institutions and industries to strengthen multidisciplinary education, applied research, innovation, entrepreneurship and consulting ecosystems.

## Quality Policy

**Siddaganga Institute of Technology is committed to :**

- Impart quality education by establishing effective learning-teaching-learning processes to produce competent engineers with high professional ethics and societal responsibility.
- Create congenial environment and provide state-of-the-art infrastructure.
- Continually improve the effectiveness of the quality management system.
- Satisfy all applicable requirements.

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