



Learn Beyond

**KPR Institute of  
Engineering and  
Technology**

(Autonomous, Affiliated to Anna University)

# **CURRICULUM AND SYLLABI REGULATIONS – 2025 (REVISED)**

**Department of  
Mechanical Engineering**

## I. Vision and Mission of the Institute

### Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of industry, society, the nation and the world at large

### Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning processes through scholarly activities
- Enriching research and innovation activities in collaboration with industry and institutes of repute
- Ensuring the academic processes to uphold culture, ethics and social responsibilities

## II. Vision and Mission of the Department

### Vision

To be recognized as a premier centre in the field of mechanical engineering education, research and development to meet the changing needs of industry and society

### Mission

The mission of the department is to

- Provide fundamental and skill-based education in mechanical engineering through innovative practices in teaching and learning
- Establish centres of excellence in collaboration with reputed industries, professional bodies and research laboratories
- Promote entrepreneurship with leadership qualities, ethics, and human values for the society at large

## III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the MECHANICAL ENGINEERING (ME) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

**PEO1:** Excel in their professional career with competencies in the field of Mechanical and Allied Engineering

**PEO2:** Apply modern research and simulation tools to solve industrial and societal needs

**PEO3:** Practice professional and ethical values in their respective organizations and society

## IV. Program Outcomes (POs)

Graduates of the MECHANICAL ENGINEERING will be able to

- PO1:** Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems
- PO2:** Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development (WK1 to WK4)
- PO3:** Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required (WK5)
- PO4:** Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions (WK8)

- PO5:** Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems (WK2 and WK6)
- PO6:** The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK1, WK5, and WK7)
- PO7:** Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (WK9)
- PO8:** Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams
- PO9:** Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10:** Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments
- PO11:** Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8)

#### Knowledge and Attitude Profile (WK)

- WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
- WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
- WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
- WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
- WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
- WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
- WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development
- WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
- WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

#### V. Program Specific Outcomes (PSOs)

Graduates of the MECHANICAL ENGINEERING will be able to

- PSO1:** Design, develop and implement advanced mechanical systems by applying engineering principles for improved performance and less human effort.

**PSO2:** Apply quality tools to ensure quality, articulate maintenance principles and demonstrate managerial skills to comprehend the mechanical engineering processes and services.

## VI. PEO / PO Mapping

Following three levels of correlation should be used:

- 1: Low
- 2: Medium
- 3: High

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| PEO 1      | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 2    | 3    | 3    | 2    |
| PEO 2      | 3   | 3   | 3   | 3   | 3   | -   | -   | 1   | -   | 1    | 3    | 2    | 1    |
| PEO 3      | -   | -   | -   | -   | -   | 2   | 3   | 3   | 3   | 3    | 3    | 2    | 2    |

## VII. Mapping of Course Outcomes (COs) with Program Outcomes (POs)

| Sem | Course Title                                     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| I   | Professional Communication - I                   | -   | -   | -   | -   | -   | -   | -   | ✓   | ✓   | -    | ✓    | -    | -    |
|     | Multivariable Calculus and Applications          | ✓   | ✓   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
|     | Engineering Physics                              | ✓   | ✓   | ✓   | -   | ✓   | -   | -   | ✓   | ✓   | -    | -    | -    | -    |
|     | C Programming                                    | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -    | ✓    | -    | -    |
|     | Engineering Graphics                             | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -   | -    | ✓    | ✓    | -    |
|     | Makerspace                                       | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | -    |
|     | C Programming Laboratory                         | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -    | ✓    | -    | -    |
|     | Induction Program                                |     |     |     |     |     |     |     |     |     |      |      |      |      |
|     | Universal Human Values                           | -   | -   | -   | -   | -   | ✓   | ✓   | ✓   | -   | -    | ✓    | -    | -    |
|     | தமிழர் மரபு / Heritage of Tamils                 | -   | -   | -   | -   | -   | -   | ✓   | ✓   | -   | ✓    | -    | -    | -    |
| II  | Environmental Governance and Sustainability      | ✓   | ✓   | -   | -   | -   | ✓   | ✓   | -   | ✓   | -    | ✓    | -    | -    |
|     | Professional Skill Development - I               | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    |
|     | Professional Communication - II                  | -   | -   | -   | -   | -   | -   | -   | ✓   | ✓   | -    | ✓    | -    | -    |
|     | Mathematical Transforms in Engineering           | ✓   | ✓   | ✓   | -   | ✓   | -   | -   | -   | ✓   | -    | -    | -    | -    |
|     | Material Science                                 | ✓   | ✓   | ✓   | -   | ✓   | -   | -   | ✓   | ✓   | -    | -    | -    | -    |
|     | Engineering Chemistry                            | ✓   | ✓   | ✓   | -   | ✓   | -   | -   | ✓   | ✓   | -    | ✓    | -    | -    |
|     | Python Programming                               | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -    | ✓    | -    | -    |
|     | Basics of Electrical and Electronics Engineering | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -    | ✓    | -    | -    |
|     | Engineering Mechanics                            | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -    | ✓    | ✓    | -    |
|     | Python Programming Laboratory                    | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -   | -    | ✓    | -    | -    |
|     | Design Thinking                                  | ✓   | ✓   | ✓   | -   | -   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | -    |
|     | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | -   | -   | -   | -   | -   | -   | ✓   | ✓   | -   | ✓    | -    | -    | -    |
|     | Professional Skill Development - II              | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    |

Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

| Sem | Course Title                                         | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| III | Probability and Statistics                           | ✓   | ✓   | -   | -   | ✓   | -   | -   | -   | -   | -    | -    | ✓    | ✓    |
|     | Engineering Thermodynamics                           | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -    | ✓    | ✓    | -    |
|     | Engineering Materials and Metallurgy                 | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | -    | -    | ✓    | ✓    |
|     | Fluid Mechanics and Machinery                        | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | -   | -    | -    | ✓    | -    |
|     | Manufacturing Technology - I                         | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -    | ✓    | ✓    | ✓    |
|     | Mechanics of Solids                                  | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -   | ✓   | ✓   | -    | -    | ✓    | -    |
|     | Electrical Drives and Control                        | ✓   | ✓   | ✓   | ✓   | ✓   | -   | ✓   | ✓   | ✓   | -    | ✓    | -    | -    |
|     | Fluid Mechanics and Machinery Laboratory             | ✓   | ✓   | ✓   | ✓   | -   | -   | -   | ✓   | ✓   | -    | ✓    | ✓    | -    |
|     | Essence of Indian Traditional Knowledge              | -   | ✓   | -   | ✓   | -   | -   | ✓   | -   | -   | -    | -    | -    | -    |
|     | Professional Skill Development - III                 | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    |
| IV  | Numerical Methods and Partial Differential Equations | ✓   | ✓   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | ✓    |
|     | Manufacturing Technology - II                        | ✓   | ✓   | ✓   | ✓   | ✓   | -   | ✓   | -   | ✓   | -    | ✓    | ✓    | ✓    |
|     | Thermal Engineering                                  | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -    | ✓    | ✓    | ✓    |
|     | Theory of Machines                                   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | -   | ✓   | ✓   | -    | ✓    | ✓    | -    |
|     | Computer Aided Modelling and Assembly Laboratory     | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | ✓   | ✓   | -    | ✓    | ✓    | -    |
|     | Manufacturing Technology Laboratory - II             | ✓   | ✓   | ✓   | ✓   | ✓   | -   | -   | ✓   | ✓   | ✓    | ✓    | ✓    | -    |
|     | Indian Constitution                                  | -   | -   | -   | -   | -   | ✓   | ✓   | ✓   | -   | -    | -    | -    | -    |
|     | Professional Skill Development - IV                  | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    |

B. A.   
Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407



**MECHANICAL ENGINEERING**  
**Regulations 2025**  
**For the students admitted from 2025 onwards**  
**CHOICE BASED CREDIT SYSTEM**  
**CURRICULUM FOR I - VIII SEMESTERS**

**SEMESTER I**

| No                                                                                    | Course Code | Title                                       | Category | Type          | L | T | P | J | C         |
|---------------------------------------------------------------------------------------|-------------|---------------------------------------------|----------|---------------|---|---|---|---|-----------|
| 1                                                                                     | U25REN101   | Professional Communication - I              | HSMC     | TwL           | 2 | - | 2 | - | 3         |
| 2                                                                                     | U25RMA101   | Multivariable Calculus and Applications     | BSC      | T             | 3 | 1 | - | - | 4         |
| 3                                                                                     | U25RPH01    | Engineering Physics                         | BSC      | TwL           | 2 | - | 2 | - | 3         |
| 4                                                                                     | U25RCSG01   | C Programming                               | ESC      | T             | 3 | - | - | - | 3         |
| 5                                                                                     | U25RMEG01   | Engineering Graphics                        | ESC      | L             | - | - | 4 | - | 2         |
| 6                                                                                     | U25RGE01    | Makerspace                                  | ESC      | L             | - | - | 4 | - | 2         |
| 7                                                                                     | U25RCSG03   | C Programming Laboratory                    | ESC      | L             | - | - | 2 | - | 1         |
| <b>Total</b>                                                                          |             |                                             |          |               |   |   |   |   | <b>18</b> |
| <b>MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)</b> |             |                                             |          |               |   |   |   |   |           |
| 8                                                                                     | U25RMNC01   | Induction Program                           | MNC      | MNC           | - | - | - | - | -         |
| 9                                                                                     | U25RMCC01   | Universal Human Values                      | MCC      | MCC           | 3 | - | - | - | 3         |
| 10                                                                                    | U25RMCC02   | தமிழர் மரபு / Heritage of Tamils            | MCC      | Tamil Courses | 1 | - | - | - | 1         |
| 11                                                                                    | U25RMCC04   | Environmental Governance and Sustainability | MCC      | MCC           | 2 | - | - | - | 2         |
| 12                                                                                    | U25RMCC06   | Professional Skill Development - I          | MCC      | MCC           | - | - | - | - | 1         |
| <b>Total</b>                                                                          |             |                                             |          |               |   |   |   |   | <b>7</b>  |

**SEMESTER II**

| No                                                                                    | Course Code | Title                                            | Category | Type          | L | T | P | J | C         |
|---------------------------------------------------------------------------------------|-------------|--------------------------------------------------|----------|---------------|---|---|---|---|-----------|
| 1                                                                                     | U25REN201   | Professional Communication - II                  | HSMC     | TwL           | 2 | - | 2 | - | 3         |
| 2                                                                                     | U25RMA203   | Mathematical Transforms in Engineering           | BSC      | TwL           | 3 | - | 2 | - | 4         |
| 3                                                                                     | U25RPH03    | Material Science                                 | BSC      | TwP           | 2 | - | - | 2 | 3         |
| 4                                                                                     | U25RCY01    | Engineering Chemistry                            | BSC      | TwL           | 2 | - | 2 | - | 3         |
| 5                                                                                     | U25RCSG04   | Python Programming                               | ESC      | T             | 3 | - | - | - | 3         |
| 6                                                                                     | U25REEG01   | Basics of Electrical and Electronics Engineering | ESC      | T             | 2 | - | - | - | 2         |
| 7                                                                                     | U25RMEG03   | Engineering Mechanics                            | PCC      | T             | 3 | - | - | - | 3         |
| 8                                                                                     | U25RCSG06   | Python Programming Laboratory                    | ESC      | L             | - | - | 2 | - | 1         |
| <b>Total</b>                                                                          |             |                                                  |          |               |   |   |   |   | <b>22</b> |
| <b>MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)</b> |             |                                                  |          |               |   |   |   |   |           |
| 9                                                                                     | U25RMCC03   | Design Thinking                                  | MCC      | MCC           | 1 | - | 2 | - | 2         |
| 10                                                                                    | U25RMCC05   | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | MCC      | Tamil Courses | 1 | - | - | - | 1         |

| No    | Course Code | Title                               | Category | Type | L | T | P | J | C |
|-------|-------------|-------------------------------------|----------|------|---|---|---|---|---|
| 11    | U25RMCC07   | Professional Skill Development - II | MCC      | MCC  | - | - | - | - | 1 |
| Total |             |                                     |          |      |   |   |   |   | 4 |

## SEMESTER III

| No                                                                             | Course Code | Title                                    | Category | Type | L | T | P | J | C  |
|--------------------------------------------------------------------------------|-------------|------------------------------------------|----------|------|---|---|---|---|----|
| 1                                                                              | U25MA302    | Probability and Statistics               | BSC      | TwL  | 2 | - | 2 | - | 3  |
| 2                                                                              | U25MEG04    | Engineering Thermodynamics               | PCC      | T    | 3 | - | - | - | 3  |
| 3                                                                              | U25ME301    | Engineering Materials and Metallurgy     | PCC      | T    | 3 | - | - | - | 3  |
| 4                                                                              | U25MEG05    | Fluid Mechanics and Machinery            | PCC      | T    | 3 | - | - | - | 3  |
| 5                                                                              | U25ME302    | Manufacturing Technology - I             | PCC      | TwL  | 3 | - | 2 | - | 4  |
| 6                                                                              | U25ME303    | Mechanics of Solids                      | PCC      | TwL  | 3 | - | 2 | - | 4  |
| 7                                                                              | U25EEG04    | Electrical Drives and Control            | ESC      | TwL  | 2 | - | 2 | - | 3  |
| 8                                                                              | U25ME304    | Fluid Mechanics and Machinery Laboratory | PCC      | L    | - | - | 2 | - | 1  |
| Total                                                                          |             |                                          |          |      |   |   |   |   | 24 |
| MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC) |             |                                          |          |      |   |   |   |   |    |
| 9                                                                              | U25MNC02    | Essence of Indian Traditional Knowledge  | MNC      | MNC  | 1 | - | - | - | -  |
| 10                                                                             | U25RMCC08   | Professional Skill Development - III     | MCC      | MCC  | - | - | - | - | 1  |
| Total                                                                          |             |                                          |          |      |   |   |   |   | 1  |

## SEMESTER IV

| No                                                                             | Course Code | Title                                                | Category | Type | L | T | P | J | C  |
|--------------------------------------------------------------------------------|-------------|------------------------------------------------------|----------|------|---|---|---|---|----|
| 1                                                                              | U25MA403    | Numerical Methods and Partial Differential Equations | BSC      | T    | 3 | - | - | - | 3  |
| 2                                                                              | U25ME401    | Manufacturing Technology - II                        | PCC      | T    | 3 | - | - | - | 3  |
| 3                                                                              | U25ME402    | Thermal Engineering                                  | PCC      | TwL  | 3 | - | 2 | - | 4  |
| 4                                                                              | U25MEG06    | Theory of Machines                                   | PCC      | TwL  | 3 | - | 2 | - | 4  |
| 5                                                                              | U25ME403    | Computer Aided Modelling and Assembly Laboratory     | PCC      | L    | - | - | 4 | - | 2  |
| 6                                                                              | U25ME404    | Manufacturing Technology Laboratory - II             | PCC      | LwP  | - | - | 2 | 2 | 2  |
| 7                                                                              | -           | Open Elective I                                      | OEC      | T    | 1 | - | 4 | - | 3  |
|                                                                                |             |                                                      |          |      | 3 | - | - | - |    |
|                                                                                |             |                                                      |          |      | 2 | - | 2 | - |    |
| Total                                                                          |             |                                                      |          |      |   |   |   |   | 21 |
| MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC) |             |                                                      |          |      |   |   |   |   |    |
| 8                                                                              | U25MNC03    | Indian Constitution                                  | MNC      | MNC  | 1 | - | - | - | -  |
| 9                                                                              | U25RMCC09   | Professional Skill Development - IV                  | MCC      | MCC  | - | - | - | - | 1  |
| Total                                                                          |             |                                                      |          |      |   |   |   |   | 1  |

T - Theory, L - Laboratory, TwL - Theory with Laboratory, TwP - Theory with Project

B.A.   
Head of the Department,  
Mechanical Engineering,

PR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 017

## SEMESTER I

| U25REN101 | Professional Communication - I<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: HSMC |   |   |   |   |
|-----------|------------------------------------------------------------------------------------------------------|----------------|---|---|---|---|
|           |                                                                                                      | L              | T | P | J | C |
|           |                                                                                                      | 2              | 0 | 2 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To develop professional communication skills for academic, technical and workplace environments
- To enhance the listening skills and facilitate effective pronunciation
- To enable students to communicate confidently in individual and team-based situations

## COURSE OUTCOMES:

|                                                                                                   |            |
|---------------------------------------------------------------------------------------------------|------------|
| CO 1: Use appropriate vocabulary and grammatical structures in professional communication         | Understand |
| CO 2: Communicate confidently in academic, social and workplace situations                        | Apply      |
| CO 3: Develop reading and writing skills for technical and professional purposes                  | Apply      |
| CO 4: Infer and present information using appropriate communication strategies                    | Analyze    |
| CO 5: Demonstrate effective listening, presentation, and teamwork skills in professional contexts | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |

## SYLLABUS:

## UNIT I: FOUNDATIONS OF PROFESSIONAL COMMUNICATION

6 + 6

Verbal, Non-verbal and Digital Communication - Word chain - Professional Etiquette - Self-Introduction and Elevator Pitch - Growth Mindset and Workplace Communication - Cross-cultural Communication - Professional Terminology - AI-assisted Communication Tools

## UNIT II: PROFESSIONAL READING AND WRITING

6 + 6

Reading Technical Articles - Error correction - Manuals and SOPs - Infographics and Data - Email Etiquette - Email Writing - AI-assisted Writing Tools - Ethical Use of AI - Verbal Analogy

## UNIT III: LISTENING AND INTERPERSONAL COMMUNICATION

6 + 6

Listening Barriers - Note-taking Techniques - Listening for Problem Solving - Team Communication - Conflict Resolution - Workplace Discussions - Idioms and Phrases

**UNIT IV: DIGITAL COMMUNICATION AND PRESENTATION SKILLS****6 + 6**

Storytelling Techniques - Discourse markers, linkers and cohesive devices - Data Presentation - Presentation Anxiety Management - Digital Presentation Platforms - Branding - Commonly Confused Words

**UNIT V: EMPLOYABILITY AND PROFESSIONALISM****6 + 6**

Prefixes, Suffixes and Root Words - LinkedIn Profile - Interview Skills - Group Discussion Strategies - Art of Persuasion - Entrepreneurial Communication - AI in Future Workplace

**LIST OF EXPERIMENTS**

1. Self-Introduction
2. Group Presentation
3. Listening to TED Talks
4. Listening to Documentaries
5. Digital Profiling

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. Ashraf Rizvi, Effective Technical Communication, 3rd Edition, McGraw-Hill Education, 2023
2. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2022
3. Sanjay Kumar & Pushp Lata, Communication Skills, 3rd Edition, Oxford University Press, New Delhi, 2018

**REFERENCES:**

1. Stephen E. Lucas, The Art of Public Speaking, 14th Edition, McGraw Hill Education, New York, 2023
2. Dale Carnegie, The Quick and Easy Way to Effective Speaking, Updated Edition, Simon & Schuster, New York, 2019
3. Matt Abrahams, Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot, Simon & Schuster, New York, 2024

  
 Head of the Department,  
 Mechanical Engineering,  
 SPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407



## SEMESTER I

| U25RMA101 | Multivariable Calculus and Applications<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: BSC |   |   |   |   |
|-----------|---------------------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                                               | L             | T | P | J | C |
|           |                                                                                                               | 3             | 1 | 0 | 0 | 4 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To provide a comprehensive knowledge of multivariable calculus, including, partial derivatives integral calculus, and vector calculus
- For constructing more convenient for students to apply their calculus knowledge to their various fields of study
- To develop skills in solving first and second order linear differential equations for engineering applications

## COURSE OUTCOMES:

- CO 1:** Explain the concepts of multivariable differential calculus, estimate the extreme values and Taylor's formula of two variable functions **Understand**
- CO 2:** Apply integral calculus to evaluate double integrals over various regions and compute area and volume using double integration **Apply**
- CO 3:** Apply vector calculus to compute directional derivative, divergence, curl, Green's, Stokes' and Gauss divergence theorems **Apply**
- CO 4:** Solve first order ordinary differential equations, model physical phenomena, determine appropriate methods for solving them, and interpret the results **Apply**
- CO 5:** Formulate second-order differential equations, solve the equations, and interpret the solutions for physical models **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 4       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 5       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: DIFFERENTIAL CALCULUS

9 + 3

Functions of two variables – Partial derivatives – Total derivatives – Taylor's formula for functions of two variables – Extreme Values

## UNIT II: INTEGRAL CALCULUS

9 + 3

UNIT II Double integrals – Over rectangles – Over general regions – Fubini's theorem (statement only), Area and Volume by double integration – Reversing the order of integration

**UNIT III: VECTOR CALCULUS****9 + 3**

Differentiation in vector field – Gradient of a scalar field – Directional derivative – Divergence of a vector field – Curl of a vector field – Integration in vector field – Line integrals – Work– circulation and flux – Path independence – Conservative fields – Green's – Gauss divergence and Stoke's theorems

**UNIT IV: FIRST ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS****9 + 3**

Basic concepts of ordinary differential equations – Separable and exact differential equations – Integrating factors and first-order linear differential equations – Mathematical modelling of real-world problems

**UNIT V: SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS****9 + 3**

Homogeneous linear equations of second order – linearity principle – second order homogeneous equations with constant coefficients – Euler–Cauchy equation – Non-homogeneous linear second order-solution by variation of parameters

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** 15 Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. Thomas G. B. and Finney R. L., "Calculus and Analytic Geometry", Pearson Education, New Delhi, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd, New Delhi, 2012

**REFERENCES:**

1. Wylie C. R. and Barrett L. C., "Advanced Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2013
2. Peter V.O Neil, "Advanced Engineering Mathematics", Cengage, New Delhi, 2010
3. Michael D. G, "Foundations of Applied Mathematics", Dover Publications, INC, New York, 2013
4. Gilbert Strang, "Calculus", Wellesley Cambridge Press, USA, 2017

B.A.   
 Head of the Department,  
 Mechanical Engineering.

KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407

## SEMESTER I &amp; II

| U25RPH01 | Engineering Physics<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: BSC |   |   |   |   |
|----------|-------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                                           | L             | T | P | J | C |
|          |                                                                                           | 2             | 0 | 2 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To understand the fundamental mechanical and thermal properties of solids and fluids for real-world engineering applications
- To explore advanced concepts in ultrasonic waves and their applications in imaging, testing, and sensing technologies
- To gain insights into semiconductor physics and photonics for their role in modern electronic and optical systems

## COURSE OUTCOMES:

|       |                                                                                                                             |       |
|-------|-----------------------------------------------------------------------------------------------------------------------------|-------|
| CO 1: | Apply the stress-strain behavior concepts in engineering materials and structures                                           | Apply |
| CO 2: | Apply principles of heat transfer and fluid mechanics to evaluate thermal systems and engineering applications              | Apply |
| CO 3: | Demonstrate the operation of ultrasonic wave generation and detection techniques for industrial and biomedical applications | Apply |
| CO 4: | Analyze the electrical properties and carrier transport mechanisms in semiconductors and semiconductor devices              | Apply |
| CO 5: | Demonstrate the principles of lasers and optical fibers in communication, sensing, and biomedical applications              | Apply |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 4       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 5       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: MECHANICAL PROPERTIES OF SOLIDS

6 + 6

Modulus of Elasticity – Stress-strain diagram – Poisson's ratio – Elastic and plastic deformation – Stress-strain behaviour in metals, polymers and ceramics – Bending Moment – Cantilever – Applications (GIRDERS, MEMS)

## UNIT II: FUNDAMENTALS OF HEAT TRANSFER AND FLUIDS

6 + 6

Heat transfer – Thermal expansion – Heat conductivity – Lee's Disc method – Surface tension – Viscosity – Coefficient of viscosity using Poiseuille's flow experiment – Solar water heater – Microwave oven – Heat exchangers – Radiators – Cooling towers

**UNIT III: ULTRASONICS AND ITS APPLICATIONS****6 + 6**

Properties of Ultrasonic waves – Production of ultrasonic waves – Piezoelectric Oscillator – Magnetostriction Oscillator – Velocity measurement of Ultrasonic waves – SONAR – Non-Destructive Testing – Ultrasound imaging – Ultrasonic scanning methods

**UNIT IV: SEMICONDUCTOR PHYSICS****6 + 6**

Properties – Direct and Indirect bandgap-semiconductor – Intrinsic and extrinsic Semiconductors – Carrier concentration in n-type semiconductor – P-type semiconductor – Carrier Transport in Semiconductor – Hall effect – Ohmic contacts – Schottky diode

**UNIT V: PHOTONICS****6 + 6**

Interaction of Radiation with Matter – Laser Characteristics – Population Inversion – CO<sub>2</sub> laser – Semiconductor Diode Laser – Laser applications – Total Internal Reflection – Structure and working principle of Optical fibre – Fiber optic Endoscopy – Fiber optic sensors

**LIST OF EXPERIMENTS**

1. Determine the moduli of elasticity of the given beams and evaluate them for different structural applications. (High/Medium/Low modulus)
2. Evaluate the shear moduli of the different materials and rank them for suitable applications with reference to their strength
3. Select the most effective thermal insulation material from mica, cardboard, and glass for optimal heat protection
4. Determine the Viscosity of Liquids Using Poiseuille's Method and Identify the Fastest-Flowing Liquid
5. Measure the speed of ultrasound in liquids and calculate their compressibility for different hydraulic purposes
6. Categorize the specified semiconducting materials according to their energy bandgap values
7. Determine a semiconducting material's Hall coefficient and identify its type
8. Determination of wavelength of given laser and the particle size of the given samples using diffraction method
9. Use an optical fiber to measure its light-gathering capacity and calculate the propagation angle
10. Calculate the surface tension of different liquids and examine how surfactants affect it
11. Determination of wavelength of various spectral lines by using spectrometer and grating
12. Determination of velocity of light passing through glass medium using spectrometer

**CONTACT PERIODS:**

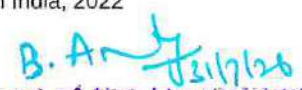
**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. M.N. Avadhanulu, P.G. Kshirsagar, and T.V.S. Arun Murthy, "A Textbook of Engineering Physics", 11th edition, S. Chand Publishing, New Delhi, 2022
2. R.K. Gaur and S.L. Gupta, "Engineering Physics", 8th edition, Dhanpat Rai Publications, New Delhi, 2017

**REFERENCES:**

1. Harald Ibach and Hans Luth, "Solid State Physics: An Introduction", 4th edition, Springer Publications, 2020
2. Charles Kittel, revised by David Pines (Editor) "Introduction to Solid State Physics", 9th edition, Wiley & Sons, US, 2020
3. H.K. Malik and A.K. Singh "Engineering Physics" Publisher: McGraw Hill Education India, 2022
4. [https://onlinecourses.nptel.ac.in/noc20\\_cy17/preview](https://onlinecourses.nptel.ac.in/noc20_cy17/preview)

  
**B. Anand**  
 Head of the Department  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407



## SEMESTER I

| U25RCSG01 | C Programming<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: ESC |   |   |   |   |
|-----------|-------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                     | L             | T | P | J | C |
|           |                                                                                     | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To enable students to understand the fundamentals of problem-solving and C programming, including algorithms, flowcharts, pseudocode, and the structure of a C program
- To develop programming skills using input/output operations, control structures, arrays, strings, functions, pointers, and dynamic memory allocation
- To introduce user-defined data types such as structures and unions for handling complex data effectively
- To familiarize students with file handling concepts and develop C-based solutions for real-world applications

## COURSE OUTCOMES:

- CO 1:** Explain fundamental programming concepts, problem-solving techniques, and the basic structure of C Understand programs
- CO 2:** Develop C programs using input/output functions, operators, decision-making, and iterative control structures Apply
- CO 3:** Implement arrays and string handling concepts to solve data processing and real-world applications Apply
- CO 4:** Develop modular and efficient programs using functions, recursion, pointers, and dynamic memory allocation techniques Apply
- CO 5:** Apply user-defined data types and file handling operations to manage and process data effectively Apply

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 4       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 5       | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | 2    | -    | -    |

## SYLLABUS:

## UNIT I: PROBLEM SOLVING APPROACHES AND C PROGRAMMING BASICS

10

Problem Solving Techniques: Problem Statement and Analysis – Problem Modelling – Identifying Input and Output Requirements – Algorithms – Flowcharts – Pseudocode for Solving Basic Scientific and Business Problems. Introduction to C: Characteristics of C – Structure of a C Program – Compiling and Executing C Program – Pre-processor Directives – Tokens – Character Set – Keywords – Identifiers – Constants – Variables – Operators – Data Types – Typcasting – Input/Output Statements in C

**UNIT II: DECISION CONTROL AND LOOPING STATEMENTS**

8

Conditional Statements: if Statement – if-else Statement – Nested if Statements – else-if Ladder – switch Statement. Looping Statements: while Loop – do-while Loop – for Loop – Nested Loops. Jump Statements: break Statement – continue Statement – goto Statement

**UNIT III: ARRAYS AND STRINGS**

9

Arrays: Declaration and Initialization – Accessing and Manipulating Array Elements – One-Dimensional Arrays – Two-Dimensional Arrays – Applications of Arrays. Strings: Declaration and Initialization of Strings – String Handling Functions – String Arrays

**UNIT IV: FUNCTIONS AND POINTERS**

9

Functions: Definition – Function Call – Function Prototype – Return Statement – Types of Functions – Recursive Functions – Command Line Arguments. Pointers: Declaration and Initialization – Pointer Arithmetic – Passing Arguments by Value and by Reference – Pointer to Pointer – Pointers and Arrays. Dynamic Memory Allocation: malloc(), calloc(), realloc(), free()

**UNIT V: USER-DEFINED DATA TYPES AND FILE MANAGEMENT**

9

Structures: Declaration and Initialization – Accessing Structure Members – Arrays of Structures – Nested Structures – Pointer to Structures. Unions – Storage Classes. Files: File Access Methods – File Modes – File Operations – File Pointers – Binary File Operations

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. Reema Thareja, "Computer Fundamentals and Programming in C", 3rd Edition, Oxford University Press, 2023
2. Brian W. Kernighan and Dennis Ritchie, "The C Programming Language", 2nd Edition, Pearson, 2015

**REFERENCES:**

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms", Then Code", 1st Edition, Springer International Publishing, 2018
2. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication
3. Juneja, B. L and Anita Seth, "Programming in C", 1st Edition, Cengage Learning India Pvt. Ltd., 2011
4. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

  
 B. Anand  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407  
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## SEMESTER I &amp; II



| U25RMEG01 | Engineering Graphics<br>(Common to BM, CE, CH, EE, ME, MI) | Category: ESC |   |   |   |   |
|-----------|------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                            | L             | T | P | J | C |
|           |                                                            | 0             | 0 | 4 | 0 | 2 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To impart knowledge of BIS standards and conventions in engineering graphics for the accurate construction of curves, projections and developments
- To develop the ability to visualize and represent 3D objects in 2D space through orthographic projections, sectional views and development of surfaces
- To enhance the drafting skills to interconvert between isometric and orthographic views for practical engineering

## COURSE OUTCOMES:

|       |                                                                                                                                               |            |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|
| CO 1: | Illustrate engineering curves with BIS standards for effective engineering communication                                                      | Understand |
| CO 2: | Apply the principles of orthographic projection to represent points, straight lines, plane surfaces, and solids on engineering drawing sheets | Apply      |
| CO 3: | Construct projections of truncated and frustums solids and develop the lateral surfaces of solids                                             | Apply      |
| CO 4: | Convert the isometric views of simple objects to orthographic views and vice versa                                                            | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    | 1    | -    |
| CO 3       | 3   | 2   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    | 1    | -    |
| CO 4       | 3   | 2   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    | 1    | -    |

## LIST OF EXPERIMENTS

- Introduction, drawing instruments and its uses, sheet layout, BIS conventions, lines, lettering and dimensioning practices lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints, parallelism, inclination and perpendicularity (Not for Exam)
- Manual construction of ellipse, parabola and hyperbola by eccentricity method
- Construction of involute of square and circle by manual drafting
- Projection of points in all four quadrants by manual drafting
- Projection of lines inclined to both horizontal and vertical planes by manual drafting
- Projection of planes inclined to both horizontal and vertical planes by manual drafting
- Projection of solids inclined to one plane and parallel to other planes
- Section of solids with base resting on HP
- Development of lateral surfaces of solids with base on HP
- Construction of isometric views of simple and truncated solids
- Sketching orthographic views from pictorial representation of 3D objects

**B.E. - ME - R2025 - CBCS**

12. Sketching simple components using modelling software

**CONTACT PERIODS:**

**Lecture:** - Periods      **Tutorial:** - Periods      **Practical:** 60 Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, Gujarat, 55th edition, 2025
2. K. Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022
3. D.M.Kulkarni, A.P.Rastogi and A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, Revised Edition, 2021

**REFERENCES:**

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2017
2. Sam Tickoo, "AutoCAD 2024 for Engineers and Designers", Dreamtech Press, 2024

B. A.   
Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

## SEMESTER I &amp; II

| U25RGE01 | Makerspace<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: ESC |   |   |   |   |
|----------|----------------------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                                  | L             | T | P | J | C |
|          |                                                                                  | 0             | 0 | 4 | 0 | 2 |

QP PATTERN: A

## COURSE OBJECTIVES:

- Apply fundamental fabrication, electrical, electronics, programming, and digital manufacturing techniques for engineering applications
- Develop practical skills in prototyping, automation, robotics, and emerging technologies through experiential learning activities
- Design and construct interdisciplinary engineering prototypes by integrating concepts from multiple engineering domains

## COURSE OUTCOMES:

|       |                                                                                                              |        |
|-------|--------------------------------------------------------------------------------------------------------------|--------|
| CO 1: | Fabricate simple components using basic mechanical engineering tools and additive manufacturing              | Apply  |
| CO 2: | Carry out electrical wiring installations applying safety measures in domestic applications                  | Apply  |
| CO 3: | Interface electronic devices to develop functional engineering solutions                                     | Apply  |
| CO 4: | Illustrate the role of automation and artificial intelligence in engineering applications                    | Apply  |
| CO 5: | Develop interdisciplinary engineering prototype addressing specific problems through teamwork and innovation | Create |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | -   | -   | 3   | -   | -   | 3   | 2   | -    | 2    | 2    | -    |
| CO 2       | 3   | 2   | -   | -   | 3   | -   | -   | 3   | 2   | -    | 2    | -    | -    |
| CO 3       | 3   | 2   | -   | -   | 3   | -   | -   | 3   | 2   | -    | 2    | 1    | -    |
| CO 4       | 2   | -   | -   | -   | 3   | -   | -   | -   | -   | -    | 2    | 3    | -    |
| CO 5       | 3   | 3   | 2   | 1   | 3   | 2   | 2   | 3   | 3   | 2    | 2    | 3    | -    |

## LIST OF EXPERIMENTS

## MODULE 1: FABRICATION AND MAKING SKILLS (10 Hours)

1. Welding procedure, selection & safety Measures - Hands-on session for preparing base material and joining of steel materials using arc welding
2. Study on basic pipe connections with different joining components.
3. Demo on laser cutting of acrylic boards and wire arc welding

## MODULE 2: DIGITAL DESIGN AND RAPID PROTOTYPING (10 Hours)

4. 3D Modelling of simple components using software's
5. Fabrication of simple components / parts using 3D printers
6. Demonstration of assembly modelling of components

## MODULE 3: AUTOMATION AND ROBOTICS (8 Hours)

7. Demonstration on mechatronics components/systems
8. Demonstration on basic robotics system
9. Demonstration on automobiles, performance measures
10. Demonstration on programmable logic control circuit

**MODULE 4: ELECTRICAL PRACTICES (10 Hours)**

11. Study on basic electrical installation tools, equipment and safety measures
12. Basic electrical wiring and connections such as soldering, fuses, earthing, miniature circuit breakers and switch wiring
13. Hands-on session of electrical connections for lightings, fans, calling bells etc
14. Hands-on session of electrical connections for motors and uninterruptible power supply

**MODULE 5: ELECTRONICS AND EMBEDDED SYSTEMS (8 Hours)**

15. Electronic components, equipment and safety measures
16. Interfacing of sensors and actuator with microcontrollers (Arduino)
17. Integration of electronic circuits with IoT system
18. Interfacing of components with printed circuit board

**MODULE 6: ARTIFICIAL INTELLIGENCE (4 Hours)**

19. Demonstration on artificial intelligence technologies
20. Demonstration on AR/VR technologies

**MODULE 7: INTERDISCIPLINARY PROTOTYPE CHALLENGE (10 Hours)**

21. Students work in teams to develop and demonstrate an interdisciplinary product/prototype for the problem identified

**CONTACT PERIODS:**

Lecture: - Periods      Tutorial: - Periods      Practical: 60 Periods      Project: - Periods      Total: 60 Periods

**TEXTBOOKS:**

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", 7th Edition, Wiley, 2020
2. Simon Monk, "Programming Arduino: Getting Started with Sketches", 3rd Edition, McGraw-Hill Education, 2022
3. Richard H. Barnett, "Introduction to Mechatronics and Measurement Systems", 6th Edition, McGraw-Hill Education, 2023
4. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016

**REFERENCES:**

1. Arduino Documentation – <https://www.arduino.cc>
2. Tinkercad Learning Portal – <https://www.tinkercad.com>
3. FreeCAD Documentation – <https://www.freecad.org>
4. Ultimaker Cura Resources – <https://ultimaker.com/software/ultimaker-cura>
5. ESP32 Documentation – <https://docs.espressif.com>

*B. A. Yashwanth*  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407



10. Implementation of applications demonstrating parameter passing mechanisms using call by value and call by reference
11. Development of applications using pointers, pointer arithmetic, and array-pointer relationships
12. Implementation of dynamic memory management applications using malloc(), calloc(), realloc(), and free()
13. Design and implementation of applications using structures, nested structures, unions, and storage classes
14. Development of file processing applications using text and binary file operations in C
15. Implementation of command-line and console-based applications integrating functions, pointers, structures, and file management concepts for real-world use cases

**CONTACT PERIODS:**

**Lecture:** - Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 30 Periods

**REFERENCES:**

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 2015
2. Reema Thareja, "Computer Fundamentals and Programming in C", 3rd Edition, Oxford University Press, 2023
3. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2023
4. Byron Gottfried, "Programming with C", 4th Edition, Schaum's Outline Series, McGraw Hill Education

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B.A. Jadhav  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

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## SEMESTER I



|           |                                                                                         |               |   |   |   |   |
|-----------|-----------------------------------------------------------------------------------------|---------------|---|---|---|---|
| U25RMNC01 | Induction Program<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MNC |   |   |   |   |
|           |                                                                                         | L             | T | P | J | C |
|           |                                                                                         | 3 Weeks       |   |   |   | 0 |

## GUIDELINES:

Students come with diverse thoughts, backgrounds and preparations. It is important to assist them adjust in the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Keeping the above thought in mind AICTE proposes a 3-week induction program for the UG students entering the institution before the commencement of normal classes which will start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, set a healthy daily routine, create bonding in the batch as well as between faculty, develop awareness, sensitivity and understanding of the self, society at large, and nature. The following are the activities under the induction program in which the student should be fully and actively engaged throughout the entire duration of the program.

**Physical Activity:** To inculcate team spirit, competitiveness, group cohesion and bonding as well as physical & mental health, physical activities like team sports, yoga, physical exercises should be conducted daily during early morning & evening. Activities like gardening may also be encouraged.

**Creative Arts:** Every student should choose one skill related to arts /visual arts/ performing arts like painting, sculpture, pottery, music, dance etc. to develop a sense of aesthetics and also to enhance creativity. The student should pursue it daily for the duration of the program.

**Universal Human Values:** Universal Human Values module will help the student to explore oneself and experience the joy of learning, stand up to peer pressure, take decisions with courage, create awareness about the relationship with colleagues and supporting staff in the hostel and department, etc.

**Literary:** Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

**Proficiency Modules:** To establish the command over skills like English, a computer familiarity etc. these modules can be taught earlier so that when norm

## CONTACT PERIODS:

Lecture: - Periods      Tutorial: - Periods      Practical: - Periods      Project: - Periods      Total: 0 Periods

## SEMESTER I

| U25RMCC01 | Universal Human Values<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MCC |   |   |   |   |
|-----------|----------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                              | L             | T | P | J | C |
|           |                                                                                              | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To understand the significance of universal human values and their role in complementing technical, intellectual, and professional skills for holistic development.
- To apply a holistic perspective in addressing personal, societal, professional, and environmental challenges through ethical and value-based approaches.
- To demonstrate responsible citizenship, professional ethics, mutual respect, and sustainable practices that contribute positively to society, industry, and the environment.

## COURSE OUTCOMES:

- CO 1:** Explain the significance of Universal Human Values and self-exploration in developing a holistic Understand perspective, enabling students to harmonize technical competence with ethical responsibility and value-based living.
- CO 2:** Differentiate the needs of the Self and the Body, and apply self-exploration to develop healthy habits, Understand value-based decision-making, and holistic well-being.
- CO 3:** Explain the concepts of natural acceptance, competence, and respect, and apply them to foster Understand harmonious relationships, resolve social conflicts, promote value education for children, and develop holistic perspectives for societal development.
- CO 4:** Demonstrate an understanding of the interconnectedness of existence and integrate holistic perspectives Apply into academic, professional, and societal contexts.
- CO 5:** Apply human values and professional knowledge to promote sustainable development, family harmony, Apply societal well-being, and responsible participation in nature.

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | 3   | 3   | -   | -   | -    | 3    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | 3   | 3   | 3   | -   | -    | 3    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | 3   | 3   | -   | -   | -    | 3    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | 3   | 3   | -   | -   | -    | 3    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | 3   | 3   | 3   | -   | -    | 3    | -    | -    |

## SYLLABUS:

B. A.   
Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.



9

**UNIT I: INTRODUCTION TO VALUE EDUCATION**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) – Understanding Value Education – Self-exploration as the Process for Value Education – Continuous Happiness and Prosperity – the Basic Human Aspirations – Happiness and Prosperity: Current Scenario – Method to Fulfil the Basic Human Aspirations. Self-Exploration Activity Topics: Sharing about Oneself – Exploring Human Consciousness

**UNIT II: HARMONY IN THE HUMAN BEING**

9

Understanding Human being as the Co-existence of the Self and the Body – Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self – Understanding Harmony in the Self – Harmony of the Self with the Body – Programme to ensure self-regulation and Health. Self-Exploration Activity Topics: Exploring the difference of Needs of Self and Body – Exploring Sources of Imagination in the Self – Exploring Harmony of Self with the Body

**UNIT III: HARMONY IN THE FAMILY AND SOCIETY**

9

Harmony in the Family – the Basic Unit of Human Interaction – 'Trust': the Foundational Value in Relationship – 'Respect': as the Right Evaluation – Other Feelings, Justice in Human-to-Human Relationship – Understanding Harmony in the Society – Vision for the Universal Human Order. Self-Exploration Activity Topics: Exploring the Feeling of Trust – Exploring the Feeling of Respect – Exploring Systems to fulfil Human Goal

**UNIT IV: HARMONY IN THE NATURE/EXISTENCE**

9

Understanding Harmony in the Nature – Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders – Realizing Existence as Co-existence at All Levels – The Holistic Perception of Harmony in Existence. Self-Exploration Activity Topics: Exploring the Four Orders of Nature – Exploring Co-existence in Existence

**UNIT V: HARMONY ON PROFESSIONAL ETHICS : HOLISTIC UNDERSTANDING**

9

Natural Acceptance of Human Values – Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order – Competence in Professional Ethics – Holistic Technologies, Production Systems and Management Models: Typical Case Studies – Strategies for Transition towards Value-based Life and Profession. Self-Exploration Activity Topics: Exploring Natural Acceptance – Exploring Ethical Human Conduct – Exploring Humanistic Models in Education – Exploring Steps of Transition towards Universal Human Order

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. R R Gaur, R. Asthana, G P Bagaria, "A Foundation course in Human Values and Professional Ethics", 3rd Edition, Excel Books, New Delhi, 2024. ISBN 978-93-87034- 47-1
2. Prof. K. V. Subba Raju, "Success Secrets for Engineering Students", Smart Student Publications, 3rd Edition, 2013.
3. R R Gaur, R Asthana, G P Bagaria, "Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**REFERENCES:**

1. Ivan Illich, "Energy & Equity", The Trinity Press, Worcester, and HarperCollins, USA, 1974.
2. E. F. Schumacher, "Small is Beautiful: a study of economics as if people mattered.", Blond & Briggs, Britain, 1973.
3. A Nagraj, "Jeevan Vidya ek Parichay", Divya Path Sansthan, Amarkantak, 1998.

B. A. M. Y.  
31/7/26  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

## SEMESTER I

| U25RMCC02 | தமிழர் மரபு / Heritage of Tamils<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MCC |   |   |   |   |
|-----------|--------------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                                        | L             | T | P | J | C |
|           |                                                                                                        | 1             | 0 | 0 | 0 | 1 |

QP PATTERN: A

## COURSE OBJECTIVES:

- Learn the extensive literature of classical Tamil
- Review the fine arts heritage of Tamil culture
- Realize the contribution of Tamils in Indian freedom struggle

## COURSE OUTCOMES:

|       |                                                                                                            |            |
|-------|------------------------------------------------------------------------------------------------------------|------------|
| CO 1: | Understand the extensive literature of Tamil and its classical nature                                      | Understand |
| CO 2: | Understand the heritage of sculpture, painting and musical instruments of ancient people                   | Understand |
| CO 3: | Review on folk and martial arts of Tamil people                                                            | Understand |
| CO 4: | Realization of Thina concepts, trade and victory of Chozha dynasty                                         | Understand |
| CO 5: | Understand the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine | Understand |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |

## SYLLABUS:

## UNIT I: LANGUAGE AND LITERATURE

3

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan

## UNIT II: HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

3

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yash and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils

## UNIT III: FOLK AND MARTIAL ARTS

3

Tattooing, basket weaving, Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyilattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils

**UNIT IV: THINAI CONCEPT OF TAMILS****3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas

**UNIT V: CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE****3**

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

**CONTACT PERIODS:**

**Lecture:** 15 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 15 Periods

**TEXTBOOKS:**

1. Jayanthi Ravikrishna K, Heritage of Tamils, Sri Krishna publications, First Edition, 2023
2. S. Priyadharshini, Heritage of Tamils, V. K. Publications

**REFERENCES:**

1. தமிழக வரலாறும் மக்களும் பண்பாடும் - கே. கே. பிள்ளை, உலகத் தமிழாராய்ச்சி நிறுவனம் (International Institute of Tamil Studies), C.P.T கேம்பஸ், சென்னை.
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணொ சொல, .சன்னை, திசம்பர் 2016
3. கீழடி - 0வ0க நதிக்க0ரயில் சங்ககொல நகர நொகரிகம், .தொல்லியல் துறை .வளையீடு, தமிழ்நொடு அரசு, .சன்னை, ஆறொம் பதிப்பு 2020
4. Social Life of Tamils, Dr. K. K. Pillay, A joint publication of TNTB & ESC and RMRL (in print) University of Madras, Chennai, Second Edition 1975
5. The Contributions of the Tamils to Indian Culture, Dr.M.Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995

B. A.   
Head of the Department,  
Mechanical Engineering.  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

**UNIT II: ATMOSPHERE AND HYDROSPHERE**

6

Atmosphere – Structure and composition – Earth's Albedo – Carbon cycle and oxygen cycle – Air Quality Standards – Air Pollution – Sources, effects and control measures – Indian Environmental Laws – Air Act 1981. Hydrosphere – Hydrosphere – Hydrological Cycle, Water Quality Parameters, Water Pollution – Sources, effects, and control measures - Water conservation – Rainwater harvesting, Dams, and watershed Management – Wastewater treatment, Ocean acidification, Blue economy, Water Act, 1974 and Environment Protection Act, 1986

Self - Learning & Case Studies – Clean Development Mechanism (CDM) – Greenhouse Gas Protocol – ISO 14064 – Jal Shakti Abhiyan – Implementation of CNG in NCT of Delhi – Taj Trapezium Case – Narmada River – Sardar Sarovar Project

**UNIT III: LITHOSPHERE AND SOLID WASTE MANAGEMENT**

6

Lithosphere – Structure of the lithosphere – Continental drift – Forest resources – Deforestation – Causes and effects – Agriculture – Effects of modern agriculture – Soil Pollution – Causes, effects and control measures. Solid Waste Management – Solid Waste – Sources, classification, and effects , Waste reduction strategies – Circular Economy and 5R Principles, Solid waste treatment, Disposal techniques, Refuse-Derived Fuel and Waste-to-Energy technologies, Biomedical, E-Waste and Hazardous waste management, Resource recovery – Environmental Standards and Waste Management Regulations (ISO 14001 and Waste Rules)

Self - Learning & Case Studies – Solid Waste Management rules, 2024 – Plastic Waste Management Rules (PWMR) – Degradation of Soil in Rajasthan – Indore's Waste Management System

**UNIT IV: GLOBAL ISSUES, HUMAN WELFARE AND ROLE OF TECHNOLOGY**

6

EIA- Concepts, stages – Land clearing projects – Environmental and social Impacts, Resettlement and Rehabilitation – Concepts and challenges – Disaster management – Floods, Landslides, Disaster management cycle and mitigation – Environmental Governance, Global Governance and Fundamental Human Rights – Importance. Human Population – Population growth, explosion and its challenges – Trends and variation among nations – Role of IT – Remote sensing, GIS and Google earth engine – Disease tracking and prediction using big data and AI (e.g., COVID-19 apps)

Self - Learning & Case Studies – Mission Amrit Sarovar – Beti Bachao Beti Padhao mission – Kerala Flood (2018) – Sterlite Copper Plant Case – Thoothukudi

**UNIT V: SUSTAINABLE DEVELOPMENT AND GREEN PRACTICES**

6

Sustainable Development – Concept, significance of sustainability – UN Sustainable Development Goals (UN SDGs) – Sustainability assessment – Carbon footprint, accounting, Carbon Neutrality – Net Zero Emissions – Carrying Capacity of the Earth – Carbon Sequestration and Carbon Capture – Blue Carbon and Green Carbon. Green Practices – Sustainable Agriculture – Green Energy – Biofuels, Green Hydrogen, Solar, wind and biomass Energy – Sustainable Transport – Electric Vehicles (EVs)

Self - Learning & Case Studies – National Solar Mission, Green India Mission – Ambikapur, Chhattisgarh – Zero Waste Model – Delhi Metro – Energy Efficiency and Sustainable Transport

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 30 Periods

**TEXTBOOKS:**

1. E. Bharucha, "Environmental Studies for Undergraduate Courses", 2nd edition, Hyderabad, University Press (India) Pvt. Ltd, 2005
2. R. Rajagopalan, "Environmental Studies: From Crisis to Cure", 3rd edition, New Delhi, Oxford University Press, 2016
3. R. R. Hiremath, "Sustainable Development", 1st edition, New Delhi, Himalaya Publishing House, 2008

**REFERENCES:**

1. Anubha Kaushik and C.P. Kaushik, "Environmental Studies" 6th edition, New Age International Publishers, New Delhi, 2018
2. Benny Joseph, "Environmental Studies", 3rd edition, New Delhi, McGraw Hill Education, 2017
3. M. Anji Reddy, "Textbook of Environmental Science and Technology", 3rd edition, BS Publications, 2019
4. R. B. Singh, "Disaster Management", 1st edition, New Delhi, Rawat Publications, 2006
5. .V. Desai, "Environment and Sustainable Development" 1st edition, Mumbai, Himalaya Publishing House, 2009

## SEMESTER I

|           |                                                                                                          |               |   |   |   |   |
|-----------|----------------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
| U25RMCC06 | Professional Skill Development - I<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MCC |   |   |   |   |
|           |                                                                                                          | L             | T | P | J | C |
|           |                                                                                                          | 15 Hours      |   |   |   | 1 |

## COURSE OUTCOMES:

- CO 1:** Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities **Apply**
- CO 2:** Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation **Apply**
- CO 3:** Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 2   | 1   | 3   | 1   | -   | -   | 2   | 2    | -    | 1    | 3    |
| CO 2       | 3   | 2   | 2   | 1   | 2   | 2   | -   | -   | 1   | 1    | -    | 3    | 3    |
| CO 3       | 3   | 2   | 2   | 1   | -   | 2   | 2   | 3   | 3   | 3    | 2    | -    | 2    |

## GUIDELINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

## CONTACT PERIODS:

Lecture: - Periods      Tutorial: - Periods      Practical: - Periods      Project: - Periods      Total: 0 Periods

## SEMESTER II



| U25REN201 | Professional Communication - II<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: HSMC |   |   |   |   |
|-----------|-------------------------------------------------------------------------------------------------------|----------------|---|---|---|---|
|           |                                                                                                       | L              | T | P | J | C |
|           |                                                                                                       | 2              | 0 | 2 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To strengthen advanced communication and interpersonal skills required for academic and professional success
- To integrate AI-enabled communication tools for content creation, presentations and professional documentation
- To prepare students for modern workplace communication in global and digital environments

## COURSE OUTCOMES:

|                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------|------------|
| CO 1: Apply advanced verbal, written and digital communication strategies in professional contexts         | Apply      |
| CO 2: Analyze technical information and produce effective workplace documents                              | Analyze    |
| CO 3: Demonstrate negotiation, leadership and collaborative communication skills                           | Understand |
| CO 4: Deliver impactful technical presentations and communicate innovative ideas effectively               | Apply      |
| CO 5: Utilize AI-assisted communication tools ethically for professional growth and workplace productivity | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | -    | 1    | -    | -    |

## SYLLABUS:

## UNIT I: TECHNICAL WRITING AND DOCUMENTATION

6 + 6

Technical Reports - Proposal Writing - Meeting Agenda and Minutes - Technical Instructions and Process Description - AI-assisted Technical Documentation - Technical Vocabulary

## UNIT II: COGNITIVE PROFESSIONALISM

6 + 6

Critical Thinking Strategies - Problem-solving Communication - Case Study - Brainstorming Techniques - Collaborative Decision Making - One-word Substitutions

## UNIT III: CAREER PLANNING

6 + 6

Self-Assessment Techniques - SWOT Analysis - Goal Setting - AI-assisted Documentation - Digital Content Writing - Collocations

**UNIT IV: CORPORATE COMMUNICATION AND NETWORKING**

**6 + 6**

Public Speaking - Welcome Address - Vote of Thanks - Anchoring and Event Hosting - Audience Engagement - Cloze tests - Discourse markers - linkers and cohesive devices

**UNIT V: CRITICAL THINKING AND COLLABORATIVE PROBLEM SOLVING**

**6 + 6**

Problem-solving Techniques - Mind Mapping - Negotiation Skills - Book Review / Film Review - Podcast and Media Analysis - Critical Reading - Group Discussion

**LIST OF EXPERIMENTS**

1. Public Speaking
2. Group Discussion
3. Case Study
4. Blog Writing
5. Mind Mapping

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. Ashraf Rizvi, Effective Technical Communication, 3rd Edition, McGraw Hill Education, 2023
2. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2023
3. Sanjay Kumar & Pushp Lata, Communication Skills, 3rd Edition, Oxford University Press, New Delhi, 2018

**REFERENCES:**

1. Stephen E. Lucas, The Art of Public Speaking, 14th Edition, McGraw Hill Education, New York, 2023
2. Dale Carnegie, The Quick and Easy Way to Effective Speaking, Updated Edition, Simon & Schuster, New York, 2019
3. Matt Abrahams, Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot, Simon & Schuster, New York, 2024

B.A. 7/3.17/26  
Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - Page 32 of 88

## SEMESTER II

| U25RMA203 | Mathematical Transforms in Engineering<br>(Common to CE, CH, EE, ME, MI) | Category: BSC |   |   |   |   |
|-----------|--------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                          | L             | T | P | J | C |
|           |                                                                          | 3             | 0 | 2 | 0 | 4 |

QP PATTERN: A

## PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

## COURSE OBJECTIVES:

- To impart the knowledge on continuous transforms: Fourier analysis and Laplace transform
- For constructing more convenient for students to apply their transforms knowledge to their various fields of study
- To provide students with a good understanding the concepts of Z-transforms for analyzing discrete-time systems

## COURSE OUTCOMES:

- CO 1:** Understand and construct Fourier series representations of periodic functions, and apply them to solve basic signal analysis and engineering problems **Understand**
- CO 2:** Apply Fourier transform techniques to analyze and interpret continuous-time signals in the frequency domain **Apply**
- CO 3:** Compute Laplace transforms and its inverse of standard functions and use them to model and analyze engineering systems **Apply**
- CO 4:** Use Laplace transforms and convolution technique to solve ordinary differential equations and system of differential equations in engineering applications **Apply**
- CO 5:** Apply discrete-time systems using Z-transforms, and solve difference equations relevant to digital signal processing and control systems **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 2   | 1   | -   | 2   | -   | -   | -   | 1   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | 2   | -   | -   | -   | 1   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | 1   | -   | 2   | -   | -   | -   | 1   | -    | -    | -    | -    |
| CO 4       | 3   | 2   | 1   | -   | 2   | -   | -   | -   | 1   | -    | -    | -    | -    |
| CO 5       | 2   | 2   | 1   | -   | 2   | -   | -   | -   | 1   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: FOURIER SERIES

9 + 6

Fourier Series –  $\pi$  and arbitrary period – Even and odd functions – Half-range expansions – Convergence and sum of a Fourier series

## UNIT II: FOURIER TRANSFORMS

9 + 6

Fourier transform – Basic properties – Fourier Cosine and Sine transforms – Convolution theorem – Discrete Fourier transform – Fast Fourier transform – DIT algorithm.

**UNIT III: LAPLACE TRANSFORMS****9 + 6**

Laplace transform – Inverse transform – Linearity, s-shifting, transforms of derivatives and integrals – Unit step function – Dirac's delta functions – Transform of periodic functions – Differentiation and integration of transforms

**UNIT IV: APPLICATION OF LAPLACE TRANSFORMS****9 + 6**

Solving linear ODEs with constant coefficients – System of ODEs – Convolution theorem – Solving integral equations – Modelling- damped vibrating system and hammer blow responses of a mass spring system

**UNIT V: Z-TRANSFORM****9 + 6**

Z-transform – Standard functions and properties – Formation of difference equation – Inverse Z-transform – Initial and final value theorems – Application of Z-transform to solve difference equations.

**LIST OF EXPERIMENTS**

1. Fourier Series – Fourier series approximations – Half-Range Expansions
2. Fourier Transforms – Fourier transform for non-periodic functions – Find the convolution for non-periodic functions
3. Laplace Transforms – Laplace Transform of special functions – Laplace transform of Periodic function
4. Application of Laplace Transform – System response using Laplace transform – Solving systems of ODEs using Laplace transform technique
5. Z-Transform Applications – Z-Transform of standard sequence – Solving difference equations using Z-transform technique

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 75 Periods

**TEXTBOOKS:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd, New Delhi, 2018
2. Dennis G. Z, "Advanced Engineering Mathematics", Jones and Bartlett Pvt Ltd, New Delhi, 2017

**REFERENCES:**

1. Andrews, L.C & Shivamoggi, B., "Integral Transforms for Engineers", SPIE Press, 2016
2. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 2016
3. Wylie C. R. & Barrett L. C., Advanced Engineering Mathematics, Tata McGraw-Hill, 2016
4. Grewal B. S., Higher Engineering Mathematics, 44th ed., Khanna Publishers, 2017

B. Anand  
 Head of the Department,  
 Mechanical Engineering,

KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407.

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## SEMESTER II

|          |                                                |               |   |   |   |   |
|----------|------------------------------------------------|---------------|---|---|---|---|
| U25RPH03 | Material Science<br>(Common to CH, EE, ME, MI) | Category: BSC |   |   |   |   |
|          |                                                | L             | T | P | J | C |
|          |                                                | 2             | 0 | 0 | 2 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To provide fundamental knowledge of advanced engineering materials including superconducting, thermoelectric, and energy storage materials for modern technological applications
- To introduce the operating principles and applications of functional materials used in sensors, electronic devices, and smart systems
- To familiarize students with emerging engineering materials such as metallic glasses, shape memory alloys, nanomaterials, and carbon nanotubes for advanced engineering applications

## COURSE OUTCOMES:

- CO 1: Make use of the properties and applications of superconducting materials and superconducting devices Apply
- CO 2: Determine the thermoelectric effects, thermoelectric materials, and their applications in energy conversion technologies Apply
- CO 3: Develop the solid state electrolyte and calculate the battery performance of the materials Apply
- CO 4: Apply characterization techniques for microstructural analysis of materials Apply
- CO 5: Apply the concepts of advanced engineering materials including metallic glasses, shape memory alloys, and nanomaterials for engineering applications Apply

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 4       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |
| CO 5       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: SUPERCONDUCTING MATERIALS

6 + 6

Superconductors – Meissner effect – Persistent current – Critical temperature – Critical magnetic field – Isotope effect – Type I, Type II superconductors – BCS theory of Superconductivity – High temperature superconductors – SQUID – Magnetic levitation

## UNIT II: MATERIALS FOR THERMOELECTRICITY

6 + 6

Thermoelectric effects (Seebeck, Peltier, Thomson) – Thermoelectric figure of merit (ZT), and material properties ( $\sigma$ , S,  $\kappa$ ) – Thermoelectric materials ( $\text{Bi}_2\text{Te}_3$ , PbTe, oxides) Applications – Waste heat recovery, cooling technologies – Hybrid vehicles

**UNIT III: ENERGY STORAGE MATERIALS****6 + 6**

Energy storage systems for portable electronics and electric vehicles – Li ion Batteries – Sodium ion – Potassium ion – Magnesium ion – Multivalent batteries – Solid-state batteries (ceramic & polymer electrolytes) – Supercapacitor materials (carbon-based, transition metal oxides, conducting polymers)

**UNIT IV: MATERIALS FOR SENSORS AND APPLICATIONS****6 + 6**

Inductance, capacitance, and resistance in sensor operation – Piezoelectric materials – pyroelectric materials – electroactive polymers – magneto-resistive and shape memory alloys – Applications of sensors in temperature, pressure, motion, and light detection

**UNIT V: NEW ENGINEERING MATERIALS****6 + 6**

Metallic glasses – Types, glass forming ability of alloys – Melt spinning process – applications – Shape memory alloys – Phases, shape memory effect – pseudoelastic effect – NiTi alloy – Applications – Nanomaterials: ball milling – chemical vapour deposition – properties and applications – Carbon nanotubes: types and applications

**LIST OF PROJECTS**

1. Magnetic Levitation Demo Using a Superconducting Kit
2. Simulation/Poster: Type I vs. Type II Superconductors
3. SQUID Applications in Medicine and Geophysics
4. Fabrication of a Simple Thermoelectric Generator (TEG)
5. ZT Calculation of a Thermoelectric Material
6. Waste Heat Recovery System for Industrial Exhaust
7. Comparison of Li-ion and Na-ion Battery Performance
8. Development of a Solid-State Electrolyte
9. High-Capacitance Supercapacitor Using Carbon Nanomaterials
10. Multifunctional Sensor Using Piezoelectric Material
11. Smart Glove with Embedded Sensors
12. Design of a Pyroelectric Motion Detector
13. Study of Critical Temperature of YBCO Superconductor
14. Fabrication of a Metallic Glass Ribbon via Melt Spinning (Simulation/Model)
15. NiTi Shape Memory Alloy Demonstration

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** 30 Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. Serway, R.A. & Jewett, J.W., "Physics for Scientists and Engineers", 10th Edition, Cengage Learning, 2018
2. Budinski, K.G. & Budinski, M.K., "Engineering Materials: Properties and Selection", 10th Edition, Pearson Education, 2020

**REFERENCES:**

1. Kasap, S.O., "Principles of Electronic Materials and Devices", 4th Edition, McGraw Hill Education, 2018
2. Kittel, C., "Introduction to Solid State Physics", 8th Edition, Wiley, 2004
3. Cabeza, L.F. (Ed.), "Phase Change Materials and Their Applications", Springer, 2020
4. <https://archive.nptel.ac.in/courses/115/103/115103030/>



## SEMESTER I &amp; II

| U25RCY01 | Engineering Chemistry<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME,<br>MI, SC) | Category: BSC |   |   |   |   |
|----------|------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                                                | L             | T | P | J | C |
|          |                                                                                                | 2             | 0 | 2 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To introduce the fundamentals, properties, industrial applications of polymeric materials and advanced energy storage devices
- To impart knowledge about corrosion prevention, surface treatment methods and nanomaterials
- To provide a basic understanding of semiconductor materials, microelectronics, quantum, computational chemistry and their applications

## COURSE OUTCOMES:

- CO 1:** Apply the concepts of polymer materials and their properties in solving industrial and technological challenges **Apply**
- CO 2:** Interpret the performance of batteries, solar cells, and supercapacitors for their effective energy storage applications **Apply**
- CO 3:** Utilize suitable corrosion prevention methods, surface treatment techniques and nanomaterials for industrial requirements **Apply**
- CO 4:** Apply suitable semiconductor materials, microfabrication processes and display technologies for specific applications **Apply**
- CO 5:** Utilize quantum chemistry principles and AI-assisted techniques to model, visualize, and predict material properties **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | 1    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | 1    | -    | -    |
| CO 3       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | 1    | -    | -    |
| CO 4       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | 1    | -    | -    |
| CO 5       | 3   | 2   | 1   | -   | 1   | -   | -   | 1   | 1   | -    | 1    | -    | -    |

## SYLLABUS:

## UNIT I: POLYMERIC MATERIALS

6 + 6

Polymers – Introduction – Compounding – Compression, Injection – Smart Polymers – Temperature responsive (PNIPAM), pH responsive (PAA), Light responsive (Azobenzene), 3D Printable (PLA), flexible and wearable polymers (PDMS – E-skin, RFID) – Conductive Polymers (PEDOT) – Synthesis, working and applications – Biopolymers – Classification, PEG, Alginate Hydrogel – Synthesis and applications

B. A.   
Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

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**UNIT II: ENERGY CONVERSION AND STORAGE**

6 + 6

Batteries – Classification,  $\text{LiFePO}_4$  – Construction, working and applications – Fuel Cells – Proton Exchange Membrane (PEM), Solid Oxide Fuel Cells (SOFC) – Green Hydrogen – Classification, production method, electrolysis – Organic photovoltaics – P3HT and PCBM – Working and applications – Solar Cells – Dye-Sensitized Solar Cells (DSSC), Supercapacitors – Electrostatic Double Layer – Working and application

**UNIT III: CORROSION AND NANO SCIENCE**

6 + 6

Types of corrosion – Factors influencing corrosion – Cathodic protection, Coatings – Galvanization, Epoxy, Polyurethane, Enamel, Superhydrophobic coatings – Process and applications. Surface treatments – Carburizing, Nitriding, Cyaniding – Process and applications. Nanomaterials – Introduction, 0D (Quantum dots), 1D (nanowire, nanorods and carbon nanotubes) 2D nanomaterials ( $\text{MoS}_2$ ), Size effects and quantum confinement, Synthesis – Laser ablation and Chemical Vapour Deposition (CVD), Various applications of nanomaterials

**UNIT IV: SEMICONDUCTOR AND DISPLAY TECHNOLOGY**

6 + 6

Semiconductors – Perfluoropentacene, GaN – Characteristics and applications, Neuromorphic Materials – Phase-Change Memory and Memristors – Working and applications – Liquid Crystal Displays, OLED, QLED – Working and applications – Wafer Manufacturing – Purification – Czochralski and Float Zone methods – Photolithography and microfabrication

**UNIT V: QUANTUM AND COMPUTATIONAL CHEMISTRY**

6 + 6

Quantum Chemistry – Basics, quantum numbers, shapes of atomic orbitals, Molecular Orbital Theory – ( $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$ ), Schrödinger equation (Derivation) – Qubits and Quantum Memory, Computational Chemistry – Molecular modeling – Basic Computational Methods – Software tools – iGemdock, Chem draw, Molview, Jmol – Introduction to AI and its role in the field of Chemistry

**LIST OF EXPERIMENTS**

1. Estimate the viscosity of a given polymer solution using an Ostwald viscometer and determine molecular weight of the given polymer
2. Synthesis of a polymer (Bakelite / polyaniline (PANI) and assess the physical properties of the polymer
3. Potentiometric determination and comparative study of EMF in different solutions
4. Determine maximum wavelength of absorption of a given solution to verify Beer's Law and to find unknown concentration of the given sample by Spectrophotometry / Colorimetry
5. Determination of corrosion rate of Iron and its prevention by electroplating / electroless plating
6. Synthesis of  $\text{ZnO}$  /  $\text{TiO}_2$  / Ag nanoparticles and study of their photocatalytic degradation of Methylene Blue dye
7. Recovery of Copper from waste Printed Circuit Boards (PCBs) and quantitative determination of copper content
8. Measurement of electrical conductivity of solutions using a conductometric Sensor
9. Perform molecular docking using freely available online software to investigate the binding affinity a ligand with the protein
10. Construct the 2D structure of a given compound and generate its 3D molecular model using computational tools for visualization and structural analysis

**CONTACT PERIODS:**

Lecture: 30 Periods      Tutorial: - Periods      Practical: 30 Periods      Project: - Periods      Total: 60 Periods

**TEXTBOOKS:**

1. Wiley India Pvt. Ltd., "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd., New Delhi, 2013
2. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", 12th edition, Chand Publishing, New Delhi, 2024

3. R.V. Gadag and A. Nityananda Shetty, "Engineering Chemistry", 3rd edition, I.K. International Publishing House, New Delhi, 2014

**REFERENCES:**

1. Fred W Billmeyer, "Textbook of Polymer Science", 4th edition, John Wiley & Sons, New York, 1999
2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons, "Biomaterials Science: An Introduction to Materials in Medicine", 4th edition, Academic Press, London, 2020
3. Kirby W Beard, Linden's "Handbook of Batteries", 5th edition, McGraw Hill, New York, 2019
4. John Larminie and Andrew Dicks, "Fuel Cell Systems Explained", 3rd edition, John Wiley & Sons, Chichester, 2012
5. Fontana M. G., "Corrosion Engineering", 3rd edition, McGraw-Hill Book Company, New York, 1986
6. V. Raghavan, "Materials Science and Engineering: A First Course", 6th edition, Prentice Hall of India New Delhi, 2015
7. M.F. Ashby and D.R.H. Jones, "Engineering Materials" 2: An Introduction to Microstructures, Processing and Design, 4th edition, Elsevier, UK, 2012
8. Ira N Levine, "Quantum Chemistry", 7th edition, Pearson, Boston, 2013

B. A. [Signature]  
Head of the Department,  
Mechanical Engineering,

PR Institute of Engineering and Technology  
Arasur, Coimbatore 641 407

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## SEMESTER II



| U25RCSG04 | Python Programming<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: ESC |   |   |   |   |
|-----------|------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                          | L             | T | P | J | C |
|           |                                                                                          | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To introduce the fundamental concepts of Python programming, including syntax, data types, operators, and input/output operations
- To develop problem-solving skills through the use of control structures, functions, recursion, and modular programming techniques
- To provide proficiency in Python collections, file handling, exception handling, and program organization using modules and packages
- To familiarize students with basic object-oriented programming concepts and the use of Python libraries for data analysis applications

## COURSE OUTCOMES:

- CO 1:** Explain Python programming fundamentals, including data types, operators, input/output operations, and Understand debugging techniques
- CO 2:** Develop Python programs using decision-making statements, iterative constructs, functions, recursion, and variable scope concepts Apply
- CO 3:** Implement string processing and Python collections such as lists, tuples, sets, and dictionaries to solve computational problems Apply
- CO 4:** Develop modular Python programs using file handling, exception handling, modules, and packages Apply
- CO 5:** Develop simple object-oriented programs and apply NumPy and Pandas libraries for basic data analysis applications Apply

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PS01 | PS02 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 4       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |
| CO 5       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | -    | -    |

## SYLLABUS:

## UNIT I: PYTHON FUNDAMENTALS

9

Introduction to Python – Features and Applications of Python – Installing Python – Python Interpreter – Script and Interactive Modes – Identifiers and Keywords – Variables – Data Types – Type Conversion – Operators and Expressions – Input and Output Operations – Comments and Documentation – Error Types – Testing and Debugging Basics

**UNIT II: CONTROL STRUCTURES AND FUNCTIONS**

9

Conditional Statements – Nested Conditional Statements – Iterative Statements: while Loop and for Loop – Loop Control Statements – Functions – Function Definition and Invocation – Function Arguments and Return Values – Scope of Variables – Recursive Functions – Applications of Functions in Problem Solving

**UNIT III: STRINGS AND PYTHON COLLECTIONS**

9

Strings and String Operations – Lists and List Operations – List Comprehensions – Tuples and Tuple Operations – Sets and Set Operations – Dictionaries and Dictionary Operations – Packing and Unpacking

**UNIT IV: FILE HANDLING, MODULES AND EXCEPTION HANDLING**

9

Modules and Packages – Importing Modules – Built-in Functions – File Handling – Opening and Closing Files – Reading and Writing Files – File Methods – Exception Handling – try, except, else and finally Blocks – User Defined Exceptions

**UNIT V: OBJECT-ORIENTED PROGRAMMING AND DATA ANALYSIS**

9

Classes and Objects – Creating Classes and Objects – Constructors – Instance Variables and Methods – Introduction to NumPy – Creating Arrays – Array Operations – Indexing and Slicing – Introduction to Pandas – Series and DataFrames – Reading and Displaying Data – Simple Data Analysis Applications.

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

**REFERENCES:**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", 1st Edition, Pearson India Education Services Pvt. Ltd., 2016

B. Anshu  
31/12/26  
Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore  
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## SEMESTER II



| U25REEG01 | Basics of Electrical and Electronics Engineering<br>(Common to CH, ME) | Category: ESC |   |   |   |   |
|-----------|------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                        | L             | T | P | J | C |
|           |                                                                        | 2             | 0 | 0 | 0 | 2 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To provide fundamental knowledge of electric circuit elements, network laws, and circuit analysis techniques used in DC networks
- To develop understanding of the construction, operating principles, characteristics, and applications of electrical machines such as DC motors, transformers, and induction motors
- To familiarize with semiconductor devices and their applications in rectification, voltage regulation, and amplifier circuits

## COURSE OUTCOMES:

- CO 1:** Apply circuit laws and network analysis techniques to determine electrical quantities in DC circuits **Apply**
- CO 2:** Analyze the construction, operating principles, characteristics and speed control methods of DC motors for engineering applications **Analyze**
- CO 3:** Analyze the operating principles and characteristics of transformers and three- phase induction motors under specified conditions **Analyze**
- CO 4:** Analyze the construction, operation, and characteristics of semiconductor devices such as PN junction diodes, Zener diodes, BJTs, and FETs. **Analyze**
- CO 5:** Apply semiconductor devices to develop rectifier, voltage regulator, and transistor configuration circuits for practical applications **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 2       | 3   | 3   | 2   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 3       | 3   | 3   | 2   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 4       | 3   | 3   | 2   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 5       | 3   | 2   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |

## SYLLABUS:

## UNIT I: BASIC CONCEPTS OF ELECTRIC CIRCUITS

6

Active elements – Passive elements – Sources – Elements in series and parallel connections – Star and delta conversion – Ohm's law and Kirchhoff's laws – Mesh and Nodal analysis in DC Networks

## UNIT II: DC MOTOR

6

DC motor – Construction, principle of operation, types, torque equation, characteristics and applications – Starters for DC motor: Two point , Three point – Speed control – Armature and field control

B. Anand  
Head of the Department,  
Mechanical Engineering.

**UNIT III: TRANSFORMER AND AC MOTOR**

6

Single phase transformer – Three phase induction motor – Construction, principle of operation, characteristics and applications  
– Starters – DOL, Star-delta

**UNIT IV: SEMICONDUCTOR DEVICES**

6

Construction, operation and characteristics : PN Junction , Zener Diode – BJT – FET

**UNIT V: APPLICATIONS OF SEMICONDUCTOR DEVICES**

6

Rectifier – Half wave – Full wave – Filters – Voltage regulator – Series and shunt – CE , CB and CC Configuration

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 30 Periods

**TEXTBOOKS:**

1. A. Sudhakar and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", 5th edition McGraw-Hill Education, 2019
2. R.K.Rajput, "Electrical Machines", 6th edition, Laxmi Publications, 2016
3. V.K Metha and Rohit Metha, "Principles of Electronics", 12th edition, S.Chand Publications, 2020

**REFERENCES:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", 8th edition, , McGraw-Hill Education, 2013
2. S.K. Bhattacharya, "Electrical Machines", 4th edition, McGraw-Hill Education, 2017
3. R.Sedha, "A text book of Applied Electronics", Revised edition, S.Chand Publications, 2017

*B. Anand*

Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

## SEMESTER II



| U25RMEG03 | Engineering Mechanics<br>(Common to CE, ME, MI) | Category: PCC |   |   |   |   |
|-----------|-------------------------------------------------|---------------|---|---|---|---|
|           |                                                 | L             | T | P | J | C |
|           |                                                 | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To expose various laws of force for equilibrium of rigid bodies
- To introduce the concepts of properties of surfaces and solids
- To impart knowledge on the fundamentals of dynamics of particles and friction

## COURSE OUTCOMES:

- CO 1:** Apply the principles of force systems, moments and equilibrium to analyze coplanar engineering systems **Apply**
- CO 2:** Analyze the equilibrium of rigid bodies by determining support reactions using free-body diagrams and equilibrium equations **Apply**
- CO 3:** Determine the centroid, centre of mass, centre of area and mass moments of inertia of simple and composite engineering sections **Analyze**
- CO 4:** Solve engineering problems involving kinematics, kinetics, work-energy, impulse and momentum of particles **Apply**
- CO 5:** Analyze engineering systems involving sliding friction and the planar motion of rigid bodies under translation and rotation **Analyze**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | 1    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | 1    | -    |
| CO 3       | 3   | 3   | 2   | 2   | -   | -   | -   | -   | -   | -    | 2    | 3    | -    |
| CO 4       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| CO 5       | 3   | 3   | 2   | 2   | -   | -   | -   | -   | -   | -    | 2    | 1    | -    |

## SYLLABUS:

## UNIT I: EQUILIBRIUM OF FORCES

9

Types of force systems – Coplanar concurrent forces – Resultant – Moment of a force and its application – Couples and resultant of a force system – Equations of equilibrium of coplanar concurrent and non – concurrent force systems – Lami's theorem – Polygon law of forces for resultant

## UNIT II: EQUILIBRIUM OF RIGID BODIES

9

Free body diagram – Types of supports – Support reactions – Moment of a force about a point – Moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of rigid bodies in two dimensions

**UNIT III: PROPERTIES OF SURFACES AND SOLIDS**

9

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section and Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Mass moment of inertia for prismatic and cylindrical solids

**UNIT IV: DYNAMICS OF PARTICLES**

9

Displacements, velocity and acceleration – Rectilinear motion – Curvilinear motion – Newton's laws of motion – D'Alembert's principle – Work energy equation – Impulse and momentum – Impact of elastic bodies

**UNIT V: FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**

9

Friction force – Laws of sliding friction – Equilibrium analysis of simple systems with sliding friction – Wedge friction – Rolling resistance (Basics) – Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc and sphere

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. R.C. Hibbeler, "Engineering Mechanics: Statics", Pearson Education, 15th Edition, 2023
2. K. L. Kumar, "Engineering Mechanics", McGraw Hill Education, New Delhi, 5th Edition, 2021

**REFERENCES:**

1. S. S. Bhavikatti and K. G. Rajashekarappa, "Engineering Mechanics", New Age International Publishers, New Delhi, 5th Edition, 2021
2. Irving H. Shames, "Engineering Mechanics: Statics and Dynamics", Pearson Education, Noida, 4th Edition, 2007
3. Ferdinand P. Beer, E. Russell Johnston Jr., David F. Mazurek and Phillip J. Cornwell, "Vector Mechanics for Engineers: Statics and Dynamics", McGraw Hill Education, New York, 13th Edition, 2021

B.A. 7/11/24

Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

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## SEMESTER II

| U25RCSG06 | Python Programming Laboratory<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: ESC |   |   |   |   |
|-----------|-----------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                                     | L             | T | P | J | C |
|           |                                                                                                     | 0             | 0 | 2 | 0 | 1 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To understand the fundamental concepts of Python programming and problem-solving using Python language constructs
- To apply control structures, functions, strings, and Python collections for developing efficient applications
- To develop modular applications using file handling, exception handling, modules, and packages.
- To implement basic object-oriented programming concepts and utilize Python libraries for data analysis applications

## COURSE OUTCOMES:

|       |                                                                                                                     |       |
|-------|---------------------------------------------------------------------------------------------------------------------|-------|
| CO 1: | Implement Python programs using basic language constructs, data types, operators, and input/output operations       | Apply |
| CO 2: | Develop Python programs using decision-making statements, looping constructs, functions, and recursion              | Apply |
| CO 3: | Implement applications using strings, lists, tuples, sets, and dictionaries for data processing and problem solving | Apply |
| CO 4: | Develop modular applications using file handling, exception handling, modules, and packages                         | Apply |
| CO 5: | Design applications using basic object-oriented programming concepts and Python libraries such as NumPy and Pandas  | Apply |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PS01 | PS02 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 4       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |
| CO 5       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | 1    | -    | -    |

## LIST OF EXPERIMENTS

1. Development of Python programs demonstrating variables, data types, operators, and input/output operations
2. Implementation of applications using conditional statements and nested conditional constructs
3. Development of iterative applications using for loops, while loops, and loop control statements
4. Design and implementation of console-based applications for mathematical and logical problem solving
5. Development of applications using user-defined functions and recursive functions
6. Implementation of string processing applications using Python string operations and methods
7. Development of applications using lists, tuples, sets, and dictionaries
8. Implementation of applications using list comprehensions and collection-based problem solving
9. Development of modular applications using built-in and user-defined modules
10. Implementation of file handling applications for reading, writing, and appending data

B. Anand  
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Mechanical Engineering.

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11. Development of robust applications using exception handling and user-defined exceptions
12. Design and implementation of applications using classes, objects, constructors, and instance methods
13. Development of applications demonstrating inheritance and method overriding
14. Implementation of numerical computing applications using NumPy arrays and array operations
15. Development of simple data analysis applications using Pandas Series and DataFrames

**CONTACT PERIODS:**

**Lecture:** - Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 30 Periods

**REFERENCES:**

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, Programming and Problem Solving with Python, 2nd Edition, McGraw Hill Education, 2018

*B. A. [Signature]*  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

## SEMESTER I &amp; II

| U25RMCC03 | Design Thinking<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MCC |   |   |   |   |
|-----------|---------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                       | L             | T | P | J | C |
|           |                                                                                       | 1             | 0 | 2 | 0 | 2 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To Understand the basics of Design Thinking, its principles, processes, and tools used
- To empathize with stakeholders and frame problems using structured tools and techniques
- To generate ideas and present solutions effectively using design tools

## COURSE OUTCOMES:

|                                                                                     |            |
|-------------------------------------------------------------------------------------|------------|
| CO 1: Explain purpose and features of design thinking process                       | Understand |
| CO 2: Use required tools to empathize with the stockholders to identify the problem | Apply      |
| CO 3: Comment the identified problem elaborately and clearly                        | Apply      |
| CO 4: Develop a conceptual solution for a societal problem                          | Apply      |
| CO 5: Present the identified solution to all the stakeholders                       | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 1   | -   | -   | -   | 1   | 1   | -   | 1   | 1    | 2    | 2    | -    |
| CO 2       | 2   | 1   | -   | -   | -   | 1   | 1   | -   | 1   | 1    | 2    | 3    | -    |
| CO 3       | 2   | 1   | 1   | -   | -   | 1   | 1   | 3   | 1   | 1    | 2    | 2    | -    |
| CO 4       | 3   | 3   | 2   | -   | -   | 1   | 1   | 3   | 1   | 1    | 2    | 2    | -    |
| CO 5       | 3   | 2   | -   | -   | -   | 1   | 1   | 3   | 3   | 1    | 2    | 1    | -    |

## SYLLABUS:

## UNIT I: FUNDAMENTALS OF DESIGN THINKING

5 + 10

Introduction to Design Thinking: Definition, relevance, and applications – Design Thinking – Personal Visualization, The Wheel of Life, and Balancing Priorities – Understanding and appreciating the concept of 'Design' – The 3 Laws of Design Thinking

## UNIT II: THE EMPATHIZE AND DEFINE STAGE

5 + 10

Understanding Stakeholders – Role of Empathy in Design Thinking – Tools: Persona, Journey Mapping, Stakeholder Mapping, CATWOE, Cartographic Perspective (LO), and Empathy Map – Case Study. Problem Framing and Reframing – Role of a Design Thinker – Tools: Five Whys, Anti-Pattern, Problem Paraphrasing, Introduction to LORD Skillset – Case Study

B. A. [Signature]

Head of the Department,  
Mechanical Engineering.

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**UNIT III: THE DIVERGENCE AND CONVERGENCE AND COMMUNICATION STAGE****5 + 10**

Ideation through Divergent and Convergent Thinking – Tools: Brainstorming, 10gm – 100gm–1000gm. Presenting Design Outcomes – Tools: 4Cs Framework – Case Study

**LIST OF EXPERIMENTS**

1. Design a solution for a societal problem that can be in line with sustainable development, thrust areas, industrial problems etc. under various themes like Health & Wellness: MedTech, Biotech, and HealthTech Agriculture & Rural: Agriculture, FoodTech, and Rural Development Green Energy: Renewable/Sustainable Energy and Clean and Green Technology Advanced Tech: Blockchain and Cyber Security, Robotics and Drones, and Space Technology Smart infrastructure: Smart Automation, Smart Education, Smart Vehicles, Transportation and Logistics Daily Utility & Leisure: Fitness and Sports, Tourism, Disaster Management, Games, and Toys Sustainability & Smart Cities: waste-to-wealth, disaster management, or digital twin models for resource management

**CONTACT PERIODS:**

**Lecture:** 15 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 1st edition, New York, HarperCollins Publishers Ltd, New York, 2018
2. Idris Mootee, "Design Thinking for Strategic Innovation", 1st edition, John Wiley & Sons Inc, 2013

**REFERENCES:**

1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009
2. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
3. Liedtka, Andrew King, Kevin Bennett, Book – "Solving Problems with Design Thinking – Ten Stories of What Works", Columbia Business School Publishing, 2013
4. Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, "Design thinking: Business Innovation", MJV Press, 2011
5. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation", 5th Edition, McGraw Hill Publications, 2017

B.A. 31/7/26  
 Head of the Department,  
 Mechanical Engineering,  
 CPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407  
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## SEMESTER II

| U25RMCC05 | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC) | Category: MCC |   |   |   |   |
|-----------|------------------------------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
|           |                                                                                                                        | L             | T | P | J | C |
|           |                                                                                                                        | 1             | 0 | 0 | 0 | 1 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To learn weaving, ceramic and construction technology of Tamils
- To understand the agriculture, irrigation and manufacturing technology of Tamils
- To realize the development of scientific Tamil and Tamil computing

## COURSE OUTCOMES:

|       |                                                                                              |            |
|-------|----------------------------------------------------------------------------------------------|------------|
| CO 1: | Understand the weaving and ceramic technology of ancient Tamil people nature                 | Understand |
| CO 2: | Understand the construction technology, building materials in Sangam period and case studies | Understand |
| CO 3: | Infer the metal process, coin and beads manufacturing with relevant archeological evidence   | Understand |
| CO 4: | Realize the agriculture methods, irrigation technology and pearl diving                      | Understand |
| CO 5: | Apply the knowledge of scientific Tamil and Tamil computing                                  | Understand |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | -   | 3   | 3   | -   | 2    | -    | -    | -    |

## SYLLABUS:

## UNIT I: WEAVING AND CERAMIC TECHNOLOGY

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries

## UNIT II: DESIGN AND CONSTRUCTION TECHNOLOGY

3

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo-Saracenic architecture at Madras during British Period

## UNIT III: MANUFACTURING TECHNOLOGY

3

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel, Copper and gold – Coins as source of history – Minting of Coins – Bead-making industries – Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beads – Archeological evidences – Gem stone types described in Silappathikaram

## UNIT IV: AGRICULTURE AND IRRIGATION TECHNOLOGY

3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society

## UNIT V: SCIENTIFIC TAMIL &amp; TAMIL COMPUTING

3

Development of Scientific Tamil – The role of journals in the development of scientific Tamil – Scientific Tamil vocabulary – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

**CONTACT PERIODS:**

**Lecture: 15 Periods      Tutorial: - Periods      Practical: - Periods      Project: - Periods      Total: 15 Periods**

**TEXTBOOKS:**

1. Tamils and Technology, K. Jayanthi Ravikrishna, Sri Krishna publications, Mahalakshmi Nagar, Velappanchavadi, First Edition 2023
2. Tamils and Technology, S. Priyadharshini, V. K. Publications

**REFERENCES:**

1. The Contributions of the Tamils to Indian Culture, Dr. M. Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995
2. Studies in the History of India with Special Reference to Tamil Nadu, Dr. K. K. Pillay, 1979

Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

## SEMESTER II

|           |                                                                                                              |               |   |   |   |   |
|-----------|--------------------------------------------------------------------------------------------------------------|---------------|---|---|---|---|
| U25RMCC07 | Professional Skill Development - II<br>(Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME,<br>MI, SC) | Category: MCC |   |   |   |   |
|           |                                                                                                              | L             | T | P | J | C |
|           |                                                                                                              | 15 Hours      |   |   |   | 1 |

## COURSE OUTCOMES:

- CO 1:** Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities **Apply**
- CO 2:** Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation **Apply**
- CO 3:** Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 2   | -   | 3   | 1   | -   | -   | 2   | 2    | -    | 1    | 3    |
| CO 2       | 2   | 3   | 3   | 3   | 2   | 2   | -   | -   | 1   | 1    | -    | 3    | 3    |
| CO 3       | -   | -   | 3   | -   | -   | 2   | 2   | 3   | 3   | 3    | 2    | -    | 2    |

## GUIDELINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

## CONTACT PERIODS:

Lecture: - Periods      Tutorial: - Periods      Practical: - Periods      Project: - Periods      Total: 0 Periods

  
 Head of the Department,  
 Mechanical Engineering,  
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## SEMESTER III

| U25MA302 | Probability and Statistics<br>(Common to BM, CE, CH, EC, EE, ME, MI) | Category: BSC |   |   |   |   |
|----------|----------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                      | I. T          | P | J | C |   |
|          |                                                                      | 2             | 0 | 2 | 0 | 3 |

QP PATTERN: A

## PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

## COURSE OBJECTIVES:

- To introduce the fundamental concepts of probability and statistics relevant to engineering
- To facilitate with students, use their understanding of statistical methods for data analysis and inference in their areas of study
- To develop probabilistic models to handle uncertainty and charts to check for quality control in engineering systems

## COURSE OUTCOMES:

|       |                                                                                                                                            |            |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------|------------|
| CO 1: | Explain the fundamental concepts of probability and examine discrete probability distributions                                             | Understand |
| CO 2: | Apply suitable continuous distributions, such as uniform, exponential and normal to interpret and analyse statistical data                 | Apply      |
| CO 3: | Calculate and evaluate covariance and correlation to examine the relationship between two random variables using pairs of random variables | Apply      |
| CO 4: | Determine the estimation theory of parameters, testing of hypotheses for means and apply the Chi-square test for attribute independence    | Apply      |
| CO 5: | Perform analysis of variances to compare the means of multiple samples and apply control charts to check for quality control               | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 1   | -   | -   | 1   | -   | -   | -   | -   | -    | -    | 1    | 1    |
| CO 2       | 3   | 2   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | 2    | 2    |
| CO 3       | 3   | 2   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | 2    | 2    |
| CO 4       | 3   | 2   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    |
| CO 5       | 3   | 2   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | 3    | 1    |

## SYLLABUS:

## UNIT I: ONE-DIMENSIONAL DISCRETE RANDOM VARIABLES

6 + 6

Probability – Conditional probability, independence – Baye's theorem – Discrete random variables, probability mass functions – Cumulative distribution functions – Mean and variance – Binomial, Poisson and geometric distributions

## UNIT II: ONE-DIMENSIONAL CONTINUOUS RANDOM VARIABLES

6 + 6

Continuous random variables – Probability density functions – Cumulative distribution functions – Mean and variance – Uniform, exponential, normal distributions

**UNIT III: TWO-DIMENSIONAL PROBABILITY DISTRIBUTIONS****6 + 6**

Two dimensional discrete and continuous random variables – Marginal probability distributions – Independence – Covariance – Correlation

**UNIT IV: INFERENCE STATISTICS****6 + 6**

Estimation - Point estimation – Interval estimation – Hypothesis testing – Hypotheses concerning means – Large, small samples - Chi square test for independence of attributes

**UNIT V: ANOVA AND STATISTICAL QUALITY CONTROL****6 + 6**

Analysis of variance – Completely randomized designs – Randomized block designs – Control charts for measurements ( $\bar{X}$ , R charts) – Control charts for attributes (p, np)

**LIST OF EXPERIMENTS**

1. One-Dimensional Discrete Random Variables – Mean and Variance of discrete RVs. – Discrete Probability distributions
2. One-Dimensional Continuous Random Variables – Mean and Variance of Continuous RVs. – Continuous Probability distributions
3. Two- Dimensional Probability Distributions – Marginal Probability distributions – Covariance and Correlation
4. Inferential Statistics – Estimation theory – Testing of hypotheses
5. ANOVA and SQC – Analysis of Variance. – Control charts ( $\bar{X}$ , R, p, np)

**CONTACT PERIODS:**

**Lecture:** 30 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 60 Periods

**TEXTBOOKS:**

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley, 2018
2. Richard A. Johnson, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 2017

**REFERENCES:**

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability & Statistics for Engineers & Scientists", Pearson Education, New Delhi, 2016
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, NewDelhi 2020
3. Sheldon M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic press, USA, 2020
4. Robert V. Hogg, Elliot Tanis and Dale Zimmerman, "Probability and Statistical Inference", Pearson Education, USA, 2014

## SEMESTER III

| U25MEG04 | Engineering Thermodynamics<br>(Common to ME, MI) | Category: PCC |   |   |   |   |
|----------|--------------------------------------------------|---------------|---|---|---|---|
|          |                                                  | L             | T | P | J | C |
|          |                                                  | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To comprehend fundamental thermodynamic principles and laws relevant to modern engineering applications
- To analyze energy systems and evaluate their efficiency and sustainability
- To apply thermodynamic concepts in real-world systems including HVAC, renewable energy, and electric vehicle applications

## COURSE OUTCOMES:

- CO 1:** Demonstrate the fundamental thermodynamic concepts and the application of the first law in engineering systems **Apply**
- CO 2:** Apply the second law of thermodynamics to evaluate the performance of thermal systems and identify sources of irreversibility **Apply**
- CO 3:** Interpret the thermodynamic properties of pure substances and mixtures using standard tables and charts **Apply**
- CO 4:** Analyze thermodynamic relations and simulate system performance using simulation software for various thermodynamic cycles **Analyze**
- CO 5:** Infer psychrometric processes and propose efficient HVAC and modern thermal management solutions **Analyze**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | 1   | -   | -   | -   | -    | -    | 3    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | 1   | -   | -   | -   | -    | -    | 3    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | 2   | -   | -   | -   | -    | 1    | 2    | -    |
| CO 4       | 3   | 3   | 2   | 2   | 1   | -   | -   | -   | -   | -    | 1    | 3    | -    |
| CO 5       | 3   | 3   | 2   | 2   | -   | 2   | -   | -   | -   | -    | 1    | 3    | -    |

## SYLLABUS:

## UNIT I: FUNDAMENTAL AND FIRST LAW

9

Basic concepts – System, control volume, properties, state, process, equilibrium and cycle – Zeroth law and temperature scales – First law for closed systems (energy balance) and open systems (Steady Flow Energy Equation) – Applications to engineering devices: Turbines, compressors, pumps, nozzles, boilers, and condensers – Simulation – Introduction to energy conversion – Efficiency – Sustainability perspective

B. A.   
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407

**UNIT II: SECOND LAW AND ENTROPY**

9

Limitations of the first law – Kelvin–Planck and Clausius statements – Reversibility and the Carnot cycle – Entropy as a property – The principle of entropy increase – Entropy generation – Introduction to Exergy (Availability) and irreversibility – Second law efficiency for thermal systems – Applications: Performance evaluation of heat engines – Refrigerators – Heat pumps

**UNIT III: PROPERTIES OF PURE SUBSTANCE AND GAS MIXTURES**

9

Properties of pure substances – P-V-T surfaces – Phase diagrams – Thermodynamic property tables – T-S and Mollier (h-s) diagrams for steam – Ideal Gas Model and Equations of State for real gases (e.g., Van der Waals) – Thermodynamic properties of gas mixtures: Dalton's and Amagat's Laws – Introduction to modern and eco-friendly working fluids (low-GWP refrigerants)

**UNIT IV: THERMODYNAMICS RELATIONS AND APPLICATIONS**

9

Fundamental thermodynamic relations: Maxwell relations – T-ds equations – Clapeyron equation – Application to property estimation and specific heats – Performance analysis of gas power cycles and vapor power cycles – Simulation

**UNIT V: PSYCHROMETRY AND MODERN APPLICATIONS**

9

Psychrometric properties – Psychrometric chart – Analysis of psychrometric processes using simulation – Sensible heating and cooling – Humidification and dehumidification – Adiabatic saturation – Evaporative cooling – Air conditioning load calculations – Applications in modern thermal management systems: Electric Vehicle cabin cooling/heating – Data center cooling – Sustainable HVAC design

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. P. K. Nag, "Engineering Thermodynamics", 7th Edition, McGraw Hill Education, 2025
2. Yunus A. Çengel, Michael A. Boles, "Thermodynamics: An Engineering Approach", 10th Edition, McGraw Hill, 2023
3. R. K. Rajput, "Engineering Thermodynamics", 6th Edition, Laxmi Publications, 2023

**REFERENCES:**

1. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, "Fundamentals of Engineering Thermodynamics", 9th Edition, Wiley India, 2020
2. Adrian Bejan, J. A. Jones, "Advanced Engineering Thermodynamics", 4th Edition, Wiley, 2016
3. P. Chattopadhyay, "Engineering Thermodynamics", 2nd Edition, Oxford University Press, 2016

## SEMESTER :II

| U25ME301 | Engineering Materials and Metallurgy | Category: PCC |   |   |   |   |
|----------|--------------------------------------|---------------|---|---|---|---|
|          |                                      | L             | T | P | J | C |
|          |                                      | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## PRE-REQUISITES:

- U25PH101 - Engineering Physics / U25RPH01 - Engineering Physics
- U25PH204 - Materials Science / U25RPH03 - Materials Science
- U25CY105 - Applied Chemistry for Mechanical Engineers / U25RCY01 - Engineering Chemistry

## COURSE OBJECTIVES:

- To impart knowledge on the constitution, structure, and phase transformations of metallic and non-metallic materials used in engineering applications
- To develop an understanding of the effects of alloying, heat treatment, and strengthening mechanisms on material behaviour and performance
- To enable students to apply concepts of material testing, selection, and processing techniques in solving real-world engineering problems

## COURSE OUTCOMES:

- CO 1:** Interpret phase diagrams and solidification behavior to predict microstructural development and properties of metallic alloys **Apply**
- CO 2:** Utilize knowledge of composition, structure, and alloying to select suitable ferrous and non-ferrous materials for engineering applications **Apply**
- CO 3:** Relate various heat treatment processes to resulting changes in hardness, strength, and ductility of metallic materials **Apply**
- CO 4:** Interpret the structural and bonding characteristics of polymers, ceramics, composites, and smart materials for effective material selection and design **Apply**
- CO 5:** Employ appropriate testing methods to evaluate mechanical properties and assess the performance and reliability of engineering materials **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | 1    |
| CO 2       | 3   | 2   | 1   | 1   | -   | 1   | 1   | -   | -   | -    | -    | 3    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 3    | 1    |
| CO 4       | 3   | 2   | 1   | 1   | -   | 1   | 1   | -   | -   | -    | -    | 3    | -    |
| CO 5       | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | -    | 2    | 2    |

## SYLLABUS:



**UNIT I: ALLOYS AND PHASE DIAGRAMS**

9

Constitution of alloys – Solid solutions - Substitutional and interstitial – Phase diagrams - Isomorphous – Eutectic – Eutectoid – Peritectic – and peritectoid reactions – Iron and Iron carbide equilibrium diagram – Phases and reactions in iron – Carbon diagram – TTT diagram – Continuous cooling curve

**UNIT II: FERROUS AND NON-FERROUS METATERIALS**

9

Classification of ferrous materials – Steels and cast irons – Types of steels (stainless, tool, HSLA, maraging) – Types of cast irons (grey, white, malleable, spheroidal) – Non-ferrous metals and alloys such as copper, aluminium, magnesium, nickel and titanium – Properties and applications – Effect of Alloying Elements – Purpose of alloying – Common alloying elements in steels

**UNIT III: HEAT TREATMENT**

9

Heat Treatment – Full annealing – Stress relief – Recrystallisation and spheroidising – Normalising – Hardening and Tempering of steel – Precipitation (Age) hardening of Al-Cu alloys – Isothermal transformation diagrams – Cooling curves superimposed on I.T. diagram CCR – Hardenability – Jominy end quench test – Austempering – Martempering – Case hardening – Carburizing – Nitriding – Cyaniding – Carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening

**UNIT IV: NON-METALS**

9

Non - Metals: Polymers – Thermoplastics and thermosets – Properties and applications : Acrylonitrile Butadiene Styrene – Polyamide – Polyphenylene Oxide – Polyether Ether Ketone – Urea Formaldehyde – Phenol Formaldehyde – epoxy – Ceramics: properties and applications of Silicon Carbide – Aluminium Oxide – Partially Stabilized Zirconia – Silicon Nitride – Silicon Aluminium Oxynitride – Introduction to composites: Types of composites – Metal Matrix Composite – Ceramic Matrix Composite – Polymer Matrix Composite – Applications – Smart materials

**UNIT V: MECHANICAL PROPERTIES AND DEFORMATION MECHANISM**

9

Mechanism of plastic deformation – Slip and twinning – Types of fracture – Ductile and brittle – Testing of materials under tension – Testing of materials under – compression and shear loads – Hardness test (Brinell - Vickers - Rockwell - microhardness) – Impact test – Fatigue failure (SN Curve) – Creep failure mechanisms – Testing of corrosion

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. James F. Shackelford, "Introduction to Materials Science for Engineers", 9th Edition, Pearson, 2021
2. Yip-Wah Chung, Monica Kapoor, "Introduction to Materials Science and Engineering", 2nd Edition, CRC Press, 2022

**REFERENCES:**

1. William D. Callister Jr., David G. Rethwisch, "Materials Science and Engineering: An Introduction", 10th Edition, Wiley, 2018
2. Kenneth G. Budinski, Michael K. Budinski, "Engineering Materials: Properties and Selection", 9th Edition, Pearson India, 2016
3. V. Raghavan, "Materials Science and Engineering: A First Course", 6th Edition, PHI Learning Pvt. Ltd., New Delhi, 2015

  
**B. Anand**  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 661



## SEMESTER III

| U25MEG05 | Fluid Mechanics and Machinery<br>(Common to ME, MI) | Category: PCC |   |   |   |   |
|----------|-----------------------------------------------------|---------------|---|---|---|---|
|          |                                                     | L             | T | P | J | C |
|          |                                                     | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To learn the fluid properties and their flow dynamics
- To solve the fluid flow problems and analyze the performance of the hydraulic machines
- To impart knowledge of dimensional analysis in fluid flow

## COURSE OUTCOMES:

|                                                                                                                                                                             |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| CO 1: Determine the properties of fluids and solve fluid dynamics problems                                                                                                  | Apply   |
| CO 2: Apply concepts of boundary layer, flow through pipes, and loss estimation methods to compute and analyze performance of pipe flow systems in engineering applications | Apply   |
| CO 3: Use the principles of dimensional analysis and similitude to develop dimensionless parameters and predict prototype performance from model studies in fluid systems   | Apply   |
| CO 4: Investigate the performance of pumps using velocity triangles, efficiencies and characteristic                                                                        | Analyze |
| CO 5: Evaluate the performance characteristics of turbines using velocity triangles, efficiencies and specific speed                                                        | Analyze |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| CO 2       | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | -    | 3    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| CO 4       | 3   | 3   | 2   | 2   | 1   | -   | -   | -   | -   | -    | -    | 3    | -    |
| CO 5       | 3   | 3   | 2   | 2   | 1   | -   | -   | -   | -   | -    | -    | 3    | -    |

## SYLLABUS:

## UNIT I: FLUID PROPERTIES, STATICS AND DYNAMICS

9 + 6

Importance and applications of fluid mechanics – Units and Dimensions – Properties of fluids – Mass density – Specific weight – Specific volume – Specific gravity – Viscosity – Compressibility – Surface tension – Capillarity – Pressure and its measurement (description only) – Introduction to fluid kinematics and dynamics: types of fluid flow – Continuity equation – Euler's equation of motion – Bernoulli's equation and its applications – Momentum equation – Moment of momentum equation

## UNIT II: BOUNDARY LAYER AND FLOW THROUGH PIPES

9 + 6

Boundary layer concepts – Types of boundary layer thickness – Hagen – Poiseuille equation – Losses in pipes – Loss due to friction and Darcy Weisbach equation – Moody diagram – Minor losses – Hydraulic gradient and total energy line – flow through pipes in parallel and series – Simulation of flow over a flat plate to visualize boundary layer growth using simulation software

**UNIT III: DIMENSIONAL ANALYSIS****9 + 6**

Introduction to dimensional analysis – Dimensional homogeneity – Methods of dimensional analysis – Similitude and its types – Dimensionless numbers – Model analysis and model laws – Undistorted and distorted models

**UNIT IV: HYDRAULIC PUMPS****9 + 6**

Definition and classifications – Efficiencies – Centrifugal pumps – Working principle – Velocity triangles – Work done by impeller – Specific speed – Performance curves Reciprocating pumps – Working principle – Indicator diagram – Pressure vessel – Simple problems – Performance curve generation using simulation software

**UNIT V: HYDRAULIC TURBINES****9 + 6**

Classification of turbines – Pelton Francis and Kaplan turbine: Working principles – Heads and efficiencies – Velocity triangles – Work done by the runner – Draft tube – Specific speed – Unit quantities – Performance curves – Simple problems – Performance curve generation using simulation software

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 75 Periods

**TEXTBOOKS:**

1. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 11th Edition, Laxmi Publications, 2024
2. P. N. Modi, S. M. Seth, "Hydraulics & Fluid Mechanics including Hydraulic Machines", 23rd Edition, Standard Book House, 2022

**REFERENCES:**

1. A. K. Jain, "Fluid Mechanics Including Hydraulic Machine", 13th Edition, Khanna Publishers, 2021
2. Frank M. White, "Fluid Mechanics", 9th Edition, Tata McGraw Hill, 2020
3. R. K. Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", 6th Edition, S Chand & Co Ltd, 2020

  
**B. Anand**  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407

## SEMESTER III

| U25ME302 | Manufacturing Technology - I | Category: PCC |   |   |   |   |
|----------|------------------------------|---------------|---|---|---|---|
|          |                              | L             | T | P | J | C |
|          |                              | 3             | 0 | 2 | 0 | 4 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To provide fundamental knowledge of metal casting, joining, and metal forming processes used in manufacturing engineering components
- To develop an understanding of sheet metal forming and polymer processing techniques, including process parameters, equipment, defects, and quality considerations
- To introduce modern manufacturing technologies such as robotic systems, additive manufacturing, digital simulation, Industry 4.0, IIoT, artificial intelligence, and smart manufacturing practices

## COURSE OUTCOMES:

|       |                                                                                                      |            |
|-------|------------------------------------------------------------------------------------------------------|------------|
| CO 1: | Describe the principles, equipment, and process parameters in metal casting processes                | Understand |
| CO 2: | Apply suitable joining processes, inspection methods, and automation techniques                      | Apply      |
| CO 3: | Discuss the process characteristics and applications of bulk metal forming processes                 | Understand |
| CO 4: | Interpret the principles, process characteristics, and applications of sheet metal forming processes | Understand |
| CO 5: | Demonstrate polymer processing techniques and emerging manufacturing technologies                    | Apply      |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 1   | -   | -   | 1   | 1   | -   | 2   | 1   | -    | 1    | 1    | -    |
| CO 2       | 3   | 2   | 1   | 1   | 2   | -   | -   | 2   | 1   | -    | 1    | 2    | -    |
| CO 3       | 2   | 1   | -   | -   | 1   | -   | -   | 2   | 1   | -    | -    | 1    | -    |
| CO 4       | 2   | 1   | -   | -   | 1   | -   | -   | 2   | 1   | -    | -    | 1    | -    |
| CO 5       | 3   | 2   | 1   | 1   | 3   | -   | 1   | 2   | 1   | -    | 1    | 2    | 1    |

## SYLLABUS:

## UNIT I: METAL CASTING PROCESSES

9 + 6

Introduction to manufacturing systems – Classification of manufacturing processes – Product realization cycle – Sand casting process – Pattern materials and pattern allowances – Types of moulding sands – Sand properties and testing – Core making and core prints – Gating and risering systems – Moulding machines – Flaskless moulding – Shell moulding – CO<sub>2</sub> moulding – Investment casting – Die casting – Centrifugal casting – Continuous casting – Melting furnaces: Cupola furnace, induction furnace and electric arc furnace – Casting defects, inspection and quality control – Digital simulation in casting process design

*D.A. Kulkarni*  
 Head of the Department,  
 Mechanical Engineering,  
 PR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407.  
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**UNIT II: JOINING PROCESS****9 + 6**

Principles of welding – Weldability of materials – Gas welding – Manual Metal Arc (MMA) welding – Gas Tungsten Arc Welding (GTAW/TIG) – Gas Metal Arc Welding (GMAW/MIG) – Submerged Arc Welding (SAW) – Electroslag Welding (ESW) – Friction welding – Friction Stir Welding (FSW) – Diffusion welding – Ultrasonic welding – Laser Beam Welding (LBW) – Electron Beam Welding (EBW) – Brazing – Soldering – Adhesive bonding – Robotic welding systems – Weld defects, inspection and testing methods

**UNIT III: FORMING PROCESSES****9 + 6**

Mechanics of metal forming – Hot working and cold working – Yield criteria and deformation characteristics – Forging processes: Open die, closed die and precision forging – Rolling processes: Flat rolling, shape rolling, ring rolling and thread rolling – Extrusion: Direct, indirect, hydrostatic and impact extrusion – Drawing of rods, wires and tubes – Powder forging – Isothermal forging – Defects in forming processes – Process simulation and digital manufacturing in metal forming

**UNIT IV: SHEET METAL FORMING PROCESSES****9 + 6**

Sheet metal characteristics and formability – Shearing operations – Blanking, punching, notching and trimming – Bending operations and spring-back – Deep drawing process – Stretch forming – Roll forming – Hydroforming – Rubber pad forming – Metal spinning – Superplastic forming – Explosive forming – Electromagnetic forming (Magnetic Pulse Forming) – Peen forming – Sheet metal defects and process optimization

**UNIT V: MANUFACTURE OF POLYMER COMPONENTS AND MODERN MANUFACTURING****9 + 6**

Classification of polymers – Thermoplastics and thermosetting plastics – Polymer processing characteristics – Injection moulding – Compression moulding – Transfer moulding – Blow moulding – Rotational moulding – Extrusion process – Thermoforming – Recycling of plastics – Sustainable polymer manufacturing – Additive Manufacturing Technologies: SLA, DLP, FDM, SLS, SLM, DMLS, EBM, Binder Jetting, Material Jetting, Directed Energy Deposition, Sheet Lamination and Hybrid Manufacturing Systems – Applications and Industrial Trends – Digital twins, Industrial Internet of Things (IIoT) and Artificial Intelligence in manufacturing

**LIST OF EXPERIMENTS**

1. Preparation of Green Sand Moulds
2. Metal Joining using Shielded Metal Arc Welding
3. Industrial Robot Programming for Linear and Circular Welding Paths
4. Identification of Surface Defects in Welding Components using Visual Inspection Techniques
5. Detection and Analysis of Weld Defects using Ultrasonic Testing
6. Study and Demonstration of Forging, Rolling and Extrusion Processes (Industrial Demonstration)
7. Laser Engraving Process on Acrylic/Wood Materials
8. Sheet Metal Forming Demonstration using Bending and Deep Drawing Operations
9. Injection Moulding of Polymer Components
10. Compression Moulding of Thermoset Composites

**CONTACT PERIODS:****Lecture:** 45 Periods**Tutorial:** - Periods**Practical:** 30 Periods**Project:** - Periods**Total:** 75 Periods**TEXTBOOKS:**

1. S. Kalpakjian & S. R. Schmid, "Manufacturing Engineering and Technology", 8th Edition, Pearson Education, 2020

B. Anand  
Head of the Department,

Mechanical Engineering

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

2. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", 8th Edition, Wiley India, 2024

**REFERENCES:**

1. P. N. Rao, "Manufacturing Technology – Foundry, Forming and Welding", 6th Edition, McGraw Hill Education, 2023
2. I. Gibson, D. W. Rosen & B. Stucker. "Additive Manufacturing Technologies", 4th Edition, Springer, 2024
3. S. K. Hajra Choudhury, A. K. Hajra Choudhury and Nirjhar Roy, "Elements of Workshop Technology, Vol. I: Manufacturing Processes", 16th Revised Edition, Media Promoters & Publishers Pvt. Ltd , 2021

B.A. 31/7/24  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407



**UNIT III: DEFLECTION OF BEAMS**

9 + 6

Computation of slope and deflection in beams: Double integration method – Macaulay's method – Area moment method – Conjugate beam and strain energy – Maxwell's reciprocal theorems

**UNIT IV: TORSION AND SPRINGS**

9 + 6

Torsion – Stresses and deflection – Solid circular shaft – Hollow circular shaft – Stepped shafts – Compound shafts – Shafts fixed at both ends – Stresses and deflection in helical springs – Simulation of helical springs deflection and stress distribution

**UNIT V: COLUMNS AND THIN CYLINDERS**

9 + 6

Columns – Types of columns – End conditions – Slenderness ratio – Euler's buckling theory – Rankine's theory – Effect of eccentricity – Critical load and safe load – Stresses in thin cylindrical shells under internal pressure – Circumferential and longitudinal stresses – Deformation in thin cylindrical and spherical shells – Lamé's theorem – Stress and strain contour visualization of thin cylindrical and spherical shells

**LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on mild steel and aluminium rod
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Deflection test on beams
6. Compression test on helical springs
7. Hardness test on metal specimen – Brinell and Rockwell Hardness
8. Strain measurements using Rosette strain gauge
9. Simulation of thin cylindrical shell under internal pressure – Hoop and longitudinal stress analysis
10. Simulation of torsion in solid and hollow shafts – Stress and deformation validation

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 75 Periods

**TEXTBOOKS:**

1. R. K. Bansal, "Strength of Materials", 6th Edition, Laxmi Publications (P) Ltd, 2022
2. S. S. Rattan, "Strength of Materials", 3rd Edition, McGraw Hill Publishing Co. Ltd, 2016

**REFERENCES:**

1. U. C. Jindal, "Strength of Materials", 2nd Edition, Asian Books Pvt. Ltd, 2022
2. Egor P. Popov, "Engineering Mechanics of Solids", 2nd Edition, Prentice Hall of India, 2015
3. R. Subramanian, "Strength of Materials", 3rd Edition, Oxford University Press, 2016



## SEMESTER III

| U25EEG04 | Electrical Drives and Control<br>(Common to ME, MI) | Category: ESC |   |   |   |   |
|----------|-----------------------------------------------------|---------------|---|---|---|---|
|          |                                                     | L             | T | P | J | C |
|          |                                                     | 2             | 0 | 2 | 0 | 3 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To learn the basic concepts of power semiconductor devices and electric drives
- To acquire the knowledge in the characteristics and operation of DC, AC drives and servo motors
- To understand the control techniques and applications of DC and AC drives

## COURSE OUTCOMES:

|                                                                                                             |       |
|-------------------------------------------------------------------------------------------------------------|-------|
| CO 1: Infer the construction and operation of power semiconductor devices                                   | Apply |
| CO 2: Apply the characteristics of various types of electric drives to determine the steady state stability | Apply |
| CO 3: Demonstrate the operation and control techniques of DC motor drives                                   | Apply |
| CO 4: Demonstrate the operation and control strategies of AC motor drives and servo motors                  | Apply |
| CO 5: Select the motor drives for industrial applications                                                   | Apply |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 2   | 2   | -   | -   | -   | -   | 1   | 1   | 1   | -    | 1    | -    | -    |
| CO 2       | 3   | 2   | 1   | -   | -   | -   | 1   | 1   | 1   | -    | 1    | -    | -    |
| CO 3       | 3   | 2   | 1   | 1   | 3   | -   | 1   | 1   | 1   | -    | 2    | -    | -    |
| CO 4       | 3   | 2   | 1   | 1   | 3   | -   | 1   | 1   | 1   | -    | 2    | -    | -    |
| CO 5       | 3   | 2   | 1   | 1   | 1   | -   | 1   | 1   | 1   | -    | 2    | -    | -    |

## SYLLABUS:

## UNIT I: POWER SEMICONDUCTOR DEVICES

6 + 6

Basic components of electric drive system – Load characteristics – Types of electric motor drives – Power electronic switches (SCR, MOSFET, IGBT) – Selection of drives

## UNIT II: DRIVE CHARACTERISTICS

6 + 6

Electric drive – Equations governing motor load dynamics – Steady state stability – Multi quadrant Dynamics – Selection of power rating – Speed torque characteristics – Various types of loads

## UNIT III: DC DRIVES

6 + 6

Converter: Types – 2 pulse and 6 pulse converter – Speed control of DC motors using controlled rectifiers – DC choppers: Control strategies – Four quadrant operation – BLDC motors – Principle of operation – Drive schemes

B. A. S. 23/12/2023  
Head of the Department,  
Mechanical Engineering,  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407  
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**UNIT IV: AC DRIVES****6 + 6**

Inverter: types – VSI and CSI operation – Induction motor drives – Torque equation – Speed control of 3-phase induction motor – Stator voltage and frequency control – Rotor resistance control: Slip power recovery scheme – Inverter fed induction motor drive – Servo Mechanism

**UNIT V: APPLICATIONS OF DRIVES****6 + 6**

Selection of motor – Digital techniques in speed control – Microcontroller based control of electric drives – Drive applications in robotic process automation

**LIST OF EXPERIMENTS**

1. VI characteristics of power semiconductor devices (SCR, MOSFET and IGBT)
2. Load on DC shunt motor
3. Load test on three phase induction motor
4. Single phase half controlled and fully controlled converter
5. Speed control of DC motor drive
6. Speed control of induction motor drive
7. Speed control of BLDC motor drive
8. Simulation of speed control of DC and AC drive

**CONTACT PERIODS:**

Lecture: 30 Periods      Tutorial: - Periods      Practical: 30 Periods      Project: - Periods      Total: 60 Periods

**TEXTBOOKS:**

1. Bimbhra B.S., "Power Electronics", 5th edition, Khanna Publishers, New Delhi, 2018
2. Vedam Subrahmanyam, "Electric Drives: Concepts and Applications", 2nd edition, McGraw Hill, New Delhi, 2017

**REFERENCES:**

1. Singh M.D. and Kanchandhani K.B., "Power Electronics", 2nd edition, McGraw Hill, New Delhi, 2017
2. Theraja B.L. and Theraja A.K., "A Text Book of Electrical Technology", Revised edition, S. Chand and Co. Ltd., New Delhi, 2015
3. Gopal K. Dubey, "Fundamentals of Electrical Drives", 2nd edition, Narosa Publishing House, New Delhi, 2022

  
 B.A. Singh  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407



## SEMESTER III

| U25ME304 | Fluid Mechanics and Machinery Laboratory | Category: PCC |   |   |   |   |
|----------|------------------------------------------|---------------|---|---|---|---|
|          |                                          | L             | T | P | J | C |
|          |                                          | 0             | 0 | 2 | 0 | 1 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To provide practical knowledge on fluid flow principles, flow measurement techniques and energy relationships through experimental investigation
- To develop the ability to analyze the performance characteristics of pumps and hydraulic turbines

## COURSE OUTCOMES:

- CO 1:** Verify fundamental fluid flow principles and evaluate flow parameters using various measuring devices such as venturimeter, orifice meter, and rotameter Apply
- CO 2:** Determine frictional losses in pipe flow and analyze the performance characteristics of centrifugal and reciprocating pumps Apply
- CO 3:** Analyze the performance characteristics of hydraulic turbines such as Pelton and Francis turbines and interpret their operational parameters Analyze

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | 3   | 1   | -    | 1    | 2    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | 3   | 1   | -    | 1    | 3    | -    |
| CO 3       | 3   | 3   | 2   | 2   | -   | -   | -   | 3   | 1   | -    | 1    | 3    | -    |

## LIST OF EXPERIMENTS

- Verification of Bernoulli's theorem
- Calibration of a venturimeter
- Calibration of an orifice meter
- Calibration of a rotameter
- Determination of co-efficient of friction in a pipe flow
- Performance characteristics of a centrifugal pump
- Performance characteristics of a reciprocating pump
- Performance characteristics of a Pelton wheel turbine
- Performance characteristics of a Francis turbine

## CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

## REFERENCES:

- NA

Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641667



## SEMESTER III

| U25MNC02 | Essence of Indian Traditional Knowledge<br>(Common to all programmes) | Category: MNC |   |   |   |   |
|----------|-----------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                       | L             | T | P | J | C |
|          |                                                                       | 1             | 0 | 0 | 0 | 0 |

QP PATTERN: A

## COURSE OBJECTIVES:

- Understand the Concept of culture in ancient, medieval and modern period.
- Know the need and importance of Indian languages and Literature.
- Understand the various religion and philosophy in various periods.

## COURSE OUTCOMES:

|                                                                   |            |
|-------------------------------------------------------------------|------------|
| CO 1: Understand Philosophy of Indian culture                     | Understand |
| CO 2: Distinguish the Indian languages and literature.            | Understand |
| CO 3: Learn the philosophy of ancient, medieval and modern Indian | Remember   |
| CO 4: Acquire the information about the fine arts in India        | Apply      |
| CO 5: Know the contribution of scientists different eras          | Understand |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | 2   | -   | 1   | -   | -   | 3   | -   | -   | -    | -    | -    | -    |
| CO 2       | -   | 2   | -   | 1   | -   | -   | 3   | -   | -   | -    | -    | -    | -    |
| CO 3       | -   | 2   | -   | 1   | -   | -   | 3   | -   | -   | -    | -    | -    | -    |
| CO 4       | -   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 5       | -   | 2   | -   | 1   | -   | -   | 3   | -   | -   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: INTRODUCTION TO CULTURE 5

Culture, Civilization, Culture and heritage, General characteristics of culture, Importance of culture in human literature, Indian culture, Ancient India, Medieval India, Modern India

## UNIT II: INDIAN LANGUAGES AND LITERATURE 5

Indian Languages and Literature-I: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, Literature of south India Indian Languages and Literature-II: Northern Indian Languages & literature, Temples and Temple types, Sculptors 's specialties, Temples Individualities Festivals and hopes

## UNIT III: RELIGION AND PHILOSOPHY 5

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (Selected Movements only)

B.A. 5/31/2026  
Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

**UNIT IV: ARTS, SCIENCE, TECHNOLOGY& ENGINEERING IN INDIA**

5

Indian painting, Handicrafts, Music, Divisions of Indian classical music, Modern Indian music, Dance and drama, Indian architecture (ancient, medieval and modern), Science and technology in India, Development of science in different periods, Sushruta and Charaka, sages of South India, herbal treatments, Surgery methods of healers, Yoga and pranayama practices, Herbal usages and medication-making methods.

**UNIT V: EDUCATION SYSTEM IN INDIA**

5

Education in ancient, Medieval and modern India, Aims of education, subjects, languages, science and scientists of Ancient India, Medieval India and Modern India

**CONTACT PERIODS:**

**Lecture:** 25 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 25 Periods

**TEXTBOOKS:**

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005.
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN: 978-8187276333, 2007.

**REFERENCES:**

1. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989.
2. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN: 9788120810990, 2014.
3. S. Narain, "Examinations in Ancient India", Arya Book Depot, 1993.
4. NCERT, "Position Paper on Arts, Music, Dance and Theatre", 2000.
5. B. Kumar Mohanta & Vipin Kumar Singh, "Traditional Knowledge System and Technology in India", 2012.

  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407





## SEMESTER IV

| U25MA403 | Numerical Methods and Partial Differential Equations<br>(Common to CE, EE, ME, MI) | Category: BSC |   |   |   |   |
|----------|------------------------------------------------------------------------------------|---------------|---|---|---|---|
|          |                                                                                    | L             | T | P | J | C |
|          |                                                                                    | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

## COURSE OBJECTIVES:

- To provide knowledge of numerical methods for solving nonlinear equations, systems of linear equations, interpolation, differentiation, and integration problems
- To develop the ability to formulate and solve partial differential equations using standard analytical techniques
- To impart an understanding of Fourier series and boundary value problems arising in heat flow and wave propagation

## COURSE OUTCOMES:

|                                                                                                                                              |       |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------|
| CO 1: Apply numerical methods to solve systems of linear equations and compare the efficiency of various solution techniques                 | Apply |
| CO 2: Apply interpolation techniques to estimate unknown values and analyze the accuracy of the approximations                               | Apply |
| CO 3: Implement numerical differentiation and integration methods to obtain approximate solutions and evaluate their accuracy                | Apply |
| CO 4: Apply standard methods to solve partial differential equations and interpret the resulting solutions under given conditions            | Apply |
| CO 5: Apply Fourier series and partial differential equation techniques to solve heat and wave equations under different boundary conditions | Apply |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 2       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    |
| CO 3       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    |
| CO 4       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    |
| CO 5       | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    |

## SYLLABUS:

## UNIT I: SYSTEM OF EQUATIONS

9

Solution of nonlinear equations – Newton Raphson method, Regular false – Solution of system of linear equations – Gauss elimination method, Iterative solution of linear systems by Gauss-Seidel method

## UNIT II: INTERPOLATION

9

Interpolation with equal intervals – Newton's forward and backward difference formulae, Interpolation with unequal intervals – Lagrange Interpolation

**UNIT III: NUMERICAL DIFFERENTIATION AND INTEGRATION**

9

Approximation of derivatives using interpolation polynomials for an equal interval – Numerical Integration – Trapezoidal rule, Simpson's 1/3 rule, evaluation of double integrals by Trapezoidal rule

**UNIT IV: PARTIAL DIFFERENTIAL EQUATIONS**

9

Formation of Partial Differential Equations – Lagrange's linear equation – Solution of second-order homogeneous partial differential equations with constant coefficients

**UNIT V: BOUNDARY VALUE PROBLEM**

9

Fourier Series solutions – One-dimensional wave equation – One-dimensional heat flow equation (unsteady state) – Two-dimensional heat flow equation (Steady state, Cartesian form only)

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2021
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley India Pvt Ltd, New Delhi, 2018

**REFERENCES:**

1. Curtis F Gerald and Patrick O Wheatly, "Applied Numerical Analysis", Pearson Education, New Delhi, 2017
2. Grewal, B S and Grewal J S, "Numerical Methods in Engineering and Science", , Khanna Publishers, New Delhi, 2015
3. Bali N.P., & Manish Goyal, "Engineering mathematics", 12th edition, Lakshmi Publication, 2016
4. Peter V.O`Neil, "Advanced Engineering Mathematics", Cengage, 2016



## SEMESTER IV

| U25ME401 | Manufacturing Technology - II | Category: PCC |   |   |   |   |
|----------|-------------------------------|---------------|---|---|---|---|
|          |                               | L             | T | P | J | C |
|          |                               | 3             | 0 | 0 | 0 | 3 |

QP PATTERN: A

## PRE-REQUISITES:

- U25ME302 - Manufacturing Technology - I

## COURSE OBJECTIVES:

- To impart fundamental knowledge on the mechanics of metal cutting, cutting tool materials, tool wear, tool life and machinability
- To develop an understanding of machining processes such as turning, drilling, milling, gear manufacturing and abrasive finishing processes along with machining time and power estimation
- To introduce CNC machine tools, part programming and unconventional machining processes for modern manufacturing applications

## COURSE OUTCOMES:

- CO 1: Apply the principles of metal cutting to determine cutting forces, tool wear, tool life, and machinability for machining operations Apply
- CO 2: Apply turning, drilling and milling processes for component manufacture and estimate machining time and power Apply
- CO 3: Select suitable reciprocating machine tools, broaching, gear manufacturing, and thread manufacturing processes for different engineering applications Apply
- CO 4: Select suitable abrasive machining and surface finishing processes for given applications Apply
- CO 5: Develop CNC part programs and identify appropriate unconventional machining processes for engineering components Apply

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PS01 | PS02 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | 1   | -    | -    | 2    | -    |
| CO 3       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| CO 4       | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| CO 5       | 3   | 2   | 1   | 1   | 1   | -   | 1   | -   | 1   | -    | 1    | 2    | 1    |

## SYLLABUS:

## UNIT I: MECHANICS OF CUTTING

9

Orthogonal and oblique cutting – Mechanism of chip formation – Types of chips – Chip breakers – Nomenclature of single point cutting tool – Shear plane theory – Shear stress and shear strain – Forces in machining – Merchant's force circle – Cutting tool materials – Tool wear and wear mechanisms – Cutting fluids – Temperature in machining – Surface roughness – Tool life – Machinability

B. A. Jaisankar  
Head of the Department,  
Mechanical Engineering,

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

**UNIT II: LATHE, DRILLING AND MILLING MACHINES**

9

Types of lathes - Centre lathe – Constructional features – Lathe operations – Drilling – Geometry of twist drill – Types of drilling machines – Drilling and related operations – Up milling and down milling – Types of milling machines and cutters – Milling operations – Indexing – Work holding and tool holding devices – Machining time and power estimation

**UNIT III: RECIPROCATING MACHINE TOOLS, BROACHING AND GEAR MANUFACTURING**

9

Shaper – Types and quick return mechanism – Planer – Types and operations – Slotter machine – Sawing operations – Broaching: Tool nomenclature, types of broaching machines and applications – Gear manufacturing: Gear milling, gear hobbing and gear shaping – Bevel gear generation – Gear finishing: Shaving, grinding, lapping and burnishing – Thread manufacturing: Thread cutting, thread rolling, thread milling and thread grinding

**UNIT IV: ABRASIVE PROCESSES**

9

Grinding – Specification of grinding wheel – Mechanism of metal removal in grinding – Grindability and its improvement – Dressing and truing – Types of grinding machines: Surface grinding, cylindrical grinding and centerless grinding – Honing – Lapping – Super finishing methods

**UNIT V: CNC MACHINING AND UNCONVENTIONAL MACHINING PROCESSES**

9

Constructional features of CNC machine tools – Machining centres and turning centres – CNC part programming: G and M codes, canned cycles, manual part programming for turning and milling – Tooling and work holding for CNC machines – Need for unconventional machining – Abrasive Jet Machining (AJM) – Ultrasonic Machining (USM) – Water Jet and Abrasive Water Jet Machining – Electrical Discharge Machining (EDM) and Wire cut EDM – Electrochemical Machining (ECM) – Chemical machining – Laser Beam Machining (LBM) – Electron Beam Machining (EBM) – Plasma Arc Machining (PAM) – Process parameters, capabilities and applications

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** - Periods      **Project:** - Periods      **Total:** 45 Periods

**TEXTBOOKS:**

1. S. Kalpakjian and S. R. Schmid, "Manufacturing Engineering and Technology", 8th Edition, Pearson Education, 2020
2. P. N. Rao, "Manufacturing Technology – Metal Cutting and Machine Tools (Vol. 2)", 4th Edition, McGraw Hill Education, 2018

**REFERENCES:**

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", 7th Edition, Wiley India, 2020
2. G. Boothroyd and W. A. Knight, "Fundamentals of Machining and Machine Tools", 3rd Edition, CRC Press, 2006
3. B. S. Raghuwanshi, "A Course in Workshop Technology – Vol. II (Machine Tools and Operations)", 11th Edition, Dhanpat Rai Publications, 2020

  
 B. A. Jadhav  
 Head of the Department,  
 Mechanical Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407.



## SEMESTER IV

| U25ME402 | Thermal Engineering | Category: PCC |   |   |   |   |
|----------|---------------------|---------------|---|---|---|---|
|          |                     | L             | T | P | J | C |
|          |                     | 3             | 0 | 2 | 0 | 4 |

QP PATTERN: A

## PRE-REQUISITES:

- U25RMEG04 - Engineering Thermodynamics

## COURSE OBJECTIVES:

- To apply thermodynamic and heat transfer concepts to real-world energy systems
- To evaluate the performance of engines, compressors, turbines, and refrigeration systems
- To develop analytical and experimental skills for energy efficiency and sustainability improvement

## COURSE OUTCOMES:

|                                                                                                                      |         |
|----------------------------------------------------------------------------------------------------------------------|---------|
| CO 1: Demonstrate the working and performance parameters of internal combustion engines and sustainable fuel systems | Apply   |
| CO 2: Apply thermodynamic principles to study power generation and waste heat recovery systems                       | Apply   |
| CO 3: Analyze the performance of nozzles and turbines used in various energy applications                            | Analyze |
| CO 4: Evaluate compressor systems and suggest methods for improving energy efficiency                                | Analyze |
| CO 5: Assess refrigeration, air conditioning, and emerging thermal systems for sustainable applications              | Analyze |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | 2   | 1   | 1   | 1   | -    | -    | 3    | 1    |
| CO 2       | 3   | 2   | 1   | 1   | -   | 2   | 1   | 1   | -   | -    | -    | 3    | 1    |
| CO 3       | 3   | 3   | 2   | 2   | -   | 1   | -   | 1   | -   | -    | -    | 3    | -    |
| CO 4       | 3   | 3   | 2   | 2   | 1   | 1   | -   | 1   | 1   | -    | 1    | 3    | -    |
| CO 5       | 3   | 3   | 2   | 2   | -   | 2   | 1   | 1   | 1   | -    | 1    | 3    | -    |

## SYLLABUS:

## UNIT I: IC ENGINES AND SUSTAINABLE MOBILITY

9 + 12

Working principles and performance parameters: SI engine – CI engine – Measurements: Indicated power – Brake power – Torque – Efficiencies – Combustion analysis and emission control techniques – Applications: Hybrid and electric vehicle systems – Alternative fuels – Introduction to engine management systems

## UNIT II: POWER GENERATION AND WASTE HEAT RECOVERY SYSTEMS

9 + 9

Steam and gas turbine power plants – Combined cycle (GTCC) and cogeneration (CHP) systems – Performance parameters: Heat rate – Work ratio – Cycle efficiency improvement methods – Applications: Thermal power stations – Waste heat recovery units (Recuperators, Regenerators) – Economic and environmental aspects of cogeneration

**UNIT III: STEAM NOZZLES AND TURBINES**

9

Flow through nozzles: Isentropic flow – Choking – Nozzle efficiency – Impulse and reaction principles for turbines – Compounding methods – Velocity diagrams – Governing and performance curves – Case Study: Efficiency improvement in modern gas and steam turbines through blade cooling and advanced materials

**UNIT IV: AIR COMPRESSORS**

9 + 3

Working principles: reciprocating – Rotary screw – Centrifugal compressors – Thermodynamic analysis of single-stage and multistage compression with intercooling – Performance parameters: Volumetric efficiency – Isothermal efficiency – Energy balance – Emerging Trends: Variable speed drives (VSD) – IoT-based monitoring for smart air systems

**UNIT V: REFRIGERATION, AIR-CONDITIONING AND EMERGING THERMAL SYSTEMS**

9 + 6

Vapour Compression Refrigeration (VCR) cycle: Components – Cycle analysis – Performance – Introduction to Vapour Absorption Refrigeration (VAR) using Water–LiBr and  $\text{NH}_3\text{--H}_2\text{O}$  pairs – Eco-friendly refrigerants: Classification (GWP, ODP) – Selection – Psychrometric processes: Sensible and latent heat transfer – Humidification – Dehumidification – Human comfort – Applications: HVAC in buildings – Cold storage – EV cabin thermal management

**LIST OF EXPERIMENTS**

1. Performance test on 4-stroke Diesel Engine
2. Heat Balance test on 4-stroke Diesel Engine
3. Retardation test to find Frictional Power of a Diesel Engine
4. Determination of COP of a Refrigeration System
5. Performance analysis of Air Conditioning System
6. Performance test on single/two stage reciprocating Air Compressor
7. Emission test on 4-stroke Diesel Engine
8. Study and analysis of Steam Generator and Turbine

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 75 Periods

**TEXTBOOKS:**

1. Mahesh M. Rathore, "Thermal Engineering", 6th Edition, McGraw Hill Education, 2023
2. Yunus A. Cengel, Michael A. Boles, and Mehmet Kanoğlu, "Thermodynamics: An Engineering Approach", 9th Edition, McGraw Hill, 2022
3. R.K. Rajput, "Thermal Engineering", 5th Edition, Laxmi Publications, 2020

**REFERENCES:**

1. Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt, "Fundamentals of Heat and Mass Transfer", 8th Edition, Wiley, 2017
2. Allan J. Organ, "The Air Engine: Stirling Cycle Power for a Sustainable Future", 1st Edition, Woodhead Publishing, 2007
3. Ibrahim Dincer, Marc A. Rosen, "Exergy: Energy, Environment and Sustainable Development", 3rd Edition, Elsevier, 2021
4. ASHRAE Handbook, "Fundamentals", Latest Edition, ASHRAE



## SEMESTER IV

| U25MEG06 | Theory of Machines<br>(Common to ME, MI) | Category: PCC |   |   |   |   |
|----------|------------------------------------------|---------------|---|---|---|---|
|          |                                          | L             | T | P | J | C |
|          |                                          | 3             | 0 | 2 | 0 | 4 |

QP PATTERN: A

## PRE-REQUISITES:

- U25MEG03 - Engineering Graphics / U25RMEG01 - Engineering Graphics
- U25ME201 - Engineering Mechanics / U25RMEG03 - Engineering Mechanics

## COURSE OBJECTIVES:

- To design linkages and cams for desired output motions and analyze the speed relationships in various gear train systems
- To understand and evaluate the force-motion interactions in machine components and achieve dynamic balance in mechanical systems
- To analyze control mechanisms and vibration behaviour for stable mechanical system performance

## COURSE OUTCOMES:

- CO 1: Perceive the concept mechanisms and compute the velocity and acceleration of different links in a mechanism Apply
- CO 2: Develop cam profiles for specified follower motions and use gear train analysis methods to solve engineering problems Apply
- CO 3: Analyze the dynamic forces acting on machine components and measure the degree of unbalance for mass systems Analyze
- CO 4: Investigate the functional behavior of governors and gyroscopes for controlling system stability Evaluate
- CO 5: Interpret the interdependence of vibration parameters for dynamic system analysis Evaluate

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | 2   | -   | -   | 1   | 1   | -    | 1    | 2    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | 1   | 1   | -    | 1    | 3    | -    |
| CO 3       | 3   | 3   | 2   | 2   | 1   | 1   | -   | 1   | 1   | -    | 1    | 3    | -    |
| CO 4       | 3   | 3   | 3   | 3   | 1   | 2   | -   | 1   | 1   | -    | 1    | 3    | -    |
| CO 5       | 3   | 3   | 3   | 3   | -   | 1   | -   | 1   | 1   | -    | 2    | 3    | -    |

## SYLLABUS:

## UNIT I: BASICS OF MECHANISMS AND KINEMATICS OF LINKAGE MECHANISMS

9 + 6

Classification of mechanisms – Kinematic concepts and definitions – Degree of freedom – Mobility – Kutzbach criterion – Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Straight line generators – Universal Joint – Geneva mechanism – Ratchet and Pawl mechanisms – Robot gripper mechanisms – Displacement – Velocity and acceleration analysis of simple mechanisms – Graphical method – Demonstration of linkage mechanism using simulation software

B. A. [Signature]

Head of the Department,  
Mechanical Engineering.

APR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

**UNIT II: KINEMATICS OF CAM MECHANISMS, GEARS AND GEAR TRAINS**

9 + 6

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity – Parabolic – Simple harmonic – Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Spur Gear terminology and definitions – Law of toothed gearing – Gear trains – Speed ratio – Train value – Parallel axis gear trains – Epicyclic gear trains – Velocity ratio of epicyclic gear trains by tabular method

**UNIT III: FORCE ANALYSIS AND BALANCING**

9 + 6

Dynamic force analysis – Inertia force and Inertia torque – D'Alembert's principle – Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod – Bearing loads – Crank shaft – Static and dynamic balancing – Balancing of rotating masses

**UNIT IV: MECHANISMS FOR CONTROL**

9 + 6

Governors – Types – Centrifugal governors – Gravity controlled centrifugal governors – Spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves – Gyroscopes – Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in automobiles, ships and airplanes

**UNIT V: VIBRATION**

9 + 6

Basic features of vibratory systems – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of damping – Damped vibration – Torsional vibration of shaft – Critical speeds of shafts – Forced vibration – Harmonic disturbances – Vibration isolation

**LIST OF EXPERIMENTS**

1. Dynamic analysis of cam mechanism – Determination of cam profile and jump speed
2. Simple and compound gear trains – Determinations of velocity ratio and torque
3. Balancing of rotating masses and reciprocating masses
4. Experiment on motorized gyroscope – Comparison of theoretical and experimental precessional velocity
5. Universal governors (Watt, Porter, Proell and Hartnell) – Determination of centrifugal force and equilibrium speed
6. Whirling of shaft and compound pendulum – Determination of natural frequency
7. Two rotor system – Comparison of theoretical and experimental torsional frequency
8. Vibrating table – Determination of transmissibility ratio
9. Velocity and acceleration on rigid body using simulation software
10. Active force and torque on four bar mechanism using simulation software
11. Modelling of vehicle dynamics using simulation software

**CONTACT PERIODS:**

**Lecture:** 45 Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** - Periods      **Total:** 75 Periods

**TEXTBOOKS:**

1. Rattan S.S, "Theory of Machines", 5th Edition, Tata McGraw Hill, 2019
2. Uicker J.J, Pennock G.R and Shigley J.E, "Theory of Machines and Mechanisms", 5th Edition, Oxford University Press, 2017

**REFERENCES:**

1. Ghosh A and Mallick A.K, "Theory of Mechanisms and Machines", 3rd Edition, Affiliated East-West Press Pvt. Ltd, 1998
2. Robert L. Norton, "Kinematics and Dynamics of Machinery", 3rd Edition, Tata McGraw Hill, 2020
3. Khurmi R.S and Gupta J.K, "Theory of Machines", 14th Edition, S Chand Publications, 2020

*B.A. [Signature]*  
Head of the Department,  
Mechanical Engineering,  
EPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.



## SEMESTER IV

| U25ME403 | Computer Aided Modelling and Assembly Laboratory | Category: PCC |   |   |   |   |
|----------|--------------------------------------------------|---------------|---|---|---|---|
|          |                                                  | L             | T | P | J | C |
|          |                                                  | 0             | 0 | 4 | 0 | 2 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To develop the ability to create orthographic drawings and 3D models of mechanical components and assemblies using modern CAD tools
- To enable students to apply Geometric Dimensioning and Tolerancing (GD&T) principles for functional design, manufacturing accuracy and assembly requirements

## COURSE OUTCOMES:

- CO 1:** Create accurate orthographic drawings and 3D models of machine components and assemblies using modelling software **Apply**
- CO 2:** Apply appropriate GD&T concepts including datums, form, orientation, and positional tolerances to ensure proper fit and function **Apply**
- CO 3:** Develop and simulate mechanical assemblies and mechanisms, including animation and tolerance considerations for real-time engineering applications **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | 3   | -   | -   | 3   | 2   | -    | 1    | 3    | -    |
| CO 2       | 3   | 2   | 1   | 1   | 3   | -   | -   | 3   | 2   | -    | 1    | 3    | -    |
| CO 3       | 3   | 2   | 1   | 1   | 3   | -   | -   | 3   | 2   | -    | 1    | 3    | -    |

## LIST OF EXPERIMENTS

- Create an orthographic view of the machine components for the given isometric drawings
- Construct a three-dimensional modelling and assembly of bearing
- Create a three-dimensional modelling and assembly of simple mechanism
- Generate a three-dimensional modelling and assembly of shaft and coupling
- Create a three-dimensional modelling and assembly of piston and connecting rod
- Create a three-dimensional modelling and assembly of tailstock of lathe
- Create a three-dimensional modelling and assembly of tool head of shaper
- Create a three-dimensional modelling and assembly of two-wheeler suspension system
- Construct a three-dimensional modelling and assembly of control valve
- Generate a three-dimensional modelling and assembly of jig/fixture

## CONTACT PERIODS:

Lecture: - Periods      Tutorial: - Periods      Practical: 60 Periods      Project: - Periods      Total: 60 Periods

## TEXTBOOKS:

- N.D. Bhatt & V.M. Panchal, "Machine Drawing", 50th Edition, Charotar Publishing House, 2014

B.A. Arjun  
Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

2. James D. Meadows, "Geometric Dimensioning and Tolerancing Handbook (ASME Y14.5-2009)", Latest Edition, ASME Press, 2009

**REFERENCES:**

1. P.S. Gill, "Geometric Dimensioning & Tolerancing", 3rd Edition, S.K. Kataria & Sons, 2019 (Reprint 2024)
2. P.S. Gill, "Machine Drawing", 5th Edition, S.K. Kataria & Sons, 2018



## SEMESTER IV

| U25ME404 | Manufacturing Technology Laboratory - II | Category: PCC |   |   |   |   |
|----------|------------------------------------------|---------------|---|---|---|---|
|          |                                          | L             | T | P | J | C |
|          |                                          | 0             | 0 | 2 | 2 | 2 |

QP PATTERN: A

## PRE-REQUISITES:

- U25ME302 - Manufacturing Technology - I

## COURSE OBJECTIVES:

- To provide hands-on experience in lathe, drilling, milling, gear cutting, shaping and grinding operations for manufacturing engineering components
- To develop practical skills in measuring cutting forces, CNC part programming, simulation and CNC machining operations

## COURSE OUTCOMES:

|       |                                                                                                                                                          |       |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| CO 1: | Perform lathe operations such as facing, plain, step and taper turning, knurling, thread cutting, and carry out drilling, reaming and tapping operations | Apply |
| CO 2: | Execute contour milling, spur gear cutting using an indexing head, and machining of keyways using shaping and slotting machines                          | Apply |
| CO 3: | Perform surface, cylindrical and tool and cutter grinding operations and measure cutting forces in turning using a lathe tool dynamometer                | Apply |
| CO 4: | Develop CNC part programs and carry out simulation and machining of components using CNC turning and milling operations                                  | Apply |

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 1   | 1   | -   | -   | -   | 3   | 2   | 2    | 1    | 1    | -    |
| CO 2       | 3   | 2   | 1   | 1   | -   | -   | -   | 3   | 2   | 2    | 1    | 1    | -    |
| CO 3       | 3   | 2   | 1   | 1   | 1   | -   | -   | 3   | 2   | 2    | 1    | 1    | -    |
| CO 4       | 3   | 2   | 1   | 1   | 2   | -   | -   | 3   | 2   | 2    | 1    | 2    | -    |

## LIST OF EXPERIMENTS

1. Facing, plain turning and step turning operations in a centre lathe
2. Taper turning, knurling and thread cutting operations in a centre lathe
3. Drilling, reaming and tapping operations using a drilling machine
4. Contour milling using a vertical milling machine
5. Spur gear cutting in a milling machine using an indexing head
6. Machining of keyways/slots using a shaping machine
7. Machining of keyways/slots using a slotting machine
8. Surface grinding of machined components
9. Cylindrical grinding of machined components
10. Tool and cutter grinding of single point and multi point cutting tools

B. A. [Signature]  
Head of the Department,  
Mechanical Engineering,

<PR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

11. Measurement of cutting forces in turning using a lathe tool dynamometer
12. CNC part programming and simulation of facing and turning operations in a CNC lathe
13. CNC part programming and simulation of thread cutting and grooving operations in a CNC lathe
14. CNC part programming and machining of linear and circular contour profiles in a CNC milling machine
15. CNC part programming and machining of pocketing and drilling operations in a CNC milling machine

**CONTACT PERIODS:**

**Lecture:** - Periods      **Tutorial:** - Periods      **Practical:** 30 Periods      **Project:** 30 Periods      **Total:** 60 Periods

**REFERENCES:**

1. NA

## SEMESTER IV

| U25MNC03 | Indian Constitution<br>(Common to all programmes) | Category: MNC |   |   |   |   |
|----------|---------------------------------------------------|---------------|---|---|---|---|
|          |                                                   | L             | T | P | J | C |
|          |                                                   | 1             | 0 | 0 | 0 | 0 |

QP PATTERN: A

## COURSE OBJECTIVES:

- To understand the evolution and importance of the Constitution.
- To understand salient features of the Indian Constitution and philosophy of Fundamental Rights
- To gain the knowledge about the state government and local level administration

## COURSE OUTCOMES:

- CO 1:** Understand the historical background of the Constitution making and its importance for building a democratic India Understand
- CO 2:** Understand the value of Fundamental Rights and Duties for becoming a good citizen of India Understand
- CO 3:** Analyze the powers of the Central Government Analyze
- CO 4:** Understand the role and responsibilities of State and Local Administration Understand
- CO 5:** Apply knowledge in strengthening constitutional institutions like Election Commission and UPSC for sustaining democracy Apply

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | -   | -   | -   | -   | -   | 1   | 2   | 3   | -   | -    | -    | -    | -    |
| CO 2       | -   | -   | -   | -   | -   | 1   | 2   | 3   | -   | -    | -    | -    | -    |
| CO 3       | -   | -   | -   | -   | -   | 1   | 2   | 3   | -   | -    | -    | -    | -    |
| CO 4       | -   | -   | -   | -   | -   | 1   | 2   | 3   | -   | -    | -    | -    | -    |
| CO 5       | -   | -   | -   | -   | -   | 1   | 2   | 3   | -   | -    | -    | -    | -    |

## SYLLABUS:

## UNIT I: HISTORICAL BACKGROUND OF INDIAN CONSTITUTION

5

Introduction to Indian Constitution: Constitution Meaning of the term, History of Making of the Indian Constitution, Evolution of the Indian Constitution, Drafting Committee (Composition and Working).

## UNIT II: FEATURES OF INDIAN CONSTITUTION

5

Philosophy and salient features of the Indian Constitution, Citizenship, Fundamental Rights, Duties and their significance, Directive Principles of State Policy, Rights Protective Mechanisms in India; Right to Education Act 2009; Right to Information 2005.

## UNIT III: UNION GOVERNMENT

5

Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister and Council of Ministers (with Powers and Functions), Cabinet and Central Secretariat, Union Judiciary (Supreme Court).

*B. A. J. J. J. J. J.*  
Head of the Department,  
Mechanical Engineering.

KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407.

**UNIT IV: STATE GOVERNMENT AND LOCAL ADMINISTRATION**

5

Governor, Chief Minister and Council of Ministers, State Secretariat – Roles and Responsibilities, District Administration, Head, Municipalities – Mayor and Role of Elected Representatives, Panchayati Raj, Zila Panchayat – Roles and Responsibilities, Block Level and Village Level Organizational Hierarchy

**UNIT V: CONSTITUTIONAL INSTITUTIONS**

5

Election Commission of India – Powers and Functions, Electoral Process in India, Methods of Constitutional Amendments and their Limitations, Important Constitutional and gist Emergency Provisions, Case Studies.

**CONTACT PERIODS:**

Lecture: 25 Periods

Tutorial: - Periods

Practical: - Periods

Project: - Periods

Total: 25 Periods

**TEXTBOOKS:**

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Subash Kashyap, "Indian Constitution", National Book Trust.

**REFERENCES:**

1. M. Laxmikanth, "Indian Polity", McGraw Hill Education India, 2013.
2. M. P. Jain, "Indian Constitution Law," 7th Edition, Lexis Nexis, 2014.
3. Raj Kumar, "Ambedkar and Constitution", Commonwealth Publication Pvt. Ltd., New Delhi, 2011

## SEMESTER IV

|           |                                                                   |               |   |   |   |   |
|-----------|-------------------------------------------------------------------|---------------|---|---|---|---|
| U25RMCC09 | Professional Skill Development - IV<br>(Common to all programmes) | Category: MCC |   |   |   |   |
|           |                                                                   | L             | T | P | J | C |
|           |                                                                   | 15 Hours      |   |   |   |   |

## COURSE OUTCOMES:

- CO 1:** Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities **Apply**
- CO 2:** Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation **Apply**
- CO 3:** Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning **Apply**

## CO - PO MAPPING:

| Particular | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO 1       | 3   | 2   | 2   | -   | 3   | 1   | -   | -   | 2   | 2    | -    | 1    | 3    |
| CO 2       | 2   | 3   | 3   | 3   | 2   | 2   | -   | -   | 1   | 1    | -    | 3    | 3    |
| CO 3       | -   | -   | 3   | -   | -   | 2   | 2   | 3   | 3   | 3    | 2    | -    | 2    |

## GUIDELINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

## CONTACT PERIODS:

Lecture: - Periods      Tutorial: - Periods      Practical: - Periods      Project: - Periods      Total: 0 Periods

