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# CURRICULUM STRUCTURE

## FIRST YEAR UG: B.TECH

### MECHANICAL ENGINEERING

REVISION: FRCRCE-2-25

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**Effective from Academic Year 2025-26**

Board of Studies Approval: 28/02/2025

Academic Council Approval: 14/02/2025 & 08/03/2025



Dr. DEEPAK BHOIR  
Dean Academics

Dr. BHUSHAN T. PATIL  
Head of Department

DR. SURENDRA RATHOD  
Principal



**Society of St. Francis Xavier, Pilar's**  
**Fr. Conceicao Rodrigues College of Engineering**  
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050  
(Autonomous College affiliated to University of Mumbai)

**Preamble:**

Greetings and congratulations to all the education partners Fr Conceicao Rodrigues College of Engineering for getting autonomous status to the college from the year 2024-25. University Grant Commission vide letter No. F. 2-10/2023(AC-Policy) dated 23<sup>rd</sup> Nov 2023 conferred the autonomous status to Fr. Conceicao Rodrigues College of Engineering, Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai 400050 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations,2023. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Learner, Indian Society and Industries.

We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit. Government of Maharashtra has directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4<sup>th</sup> July 2023. Accordingly degree options are given to the students admitted from academic year 2024-25 based on UGC circulars and *DTE guidelines ref no. 17/DTE/NEP-2020/2024/111 dated 4th June 2024* related to implementation of NEP. Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum, a "**H-Tree Model**" of Engineering Education. A unique "**H-Tree Model**" of Engineering Education Curriculum is carefully designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient) and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an **all-rounded** personality with **holistic** approach to education in which learner receives **25% teacher-led learning, 25% peer learning, 25% self-learning and 25% experiential learning**. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to learner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science, and mathematics foundation and program core, sequel of electives, Multidisciplinary Minor courses, humanities & management courses and sufficient experiential learning through projects and semester-long industry / research internship along with employable skill-based courses. Learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Learner also gets additional option to choose the kind of degree i.e. Honors or Double Minor or Honors with Research.

Various steps are taken to transform teaching learning process to make learning a joyful experience for students. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units.



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**Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2025-26**

| <b>Nomenclature of the courses in the curriculum</b> |   |
|--|---|
| <b>Abbreviation</b>                                  | <b>Title</b>                                      |
| BSESC  | Basic Science & Engineering Science Courses       |
| PCPEC  | Program Core and Program Elective Courses         |
| MDC  | Multidisciplinary Courses                         |
| SC   | Skill Courses                                     |
| HSSM   | Humanities, Social Sciences and Management        |
| EL   | Experiential Learning                             |
| LLC  | Liberal Learning Courses                          |
| BSC  | Basic Science Courses                             |
| ESC  | Engineering Science Courses                       |
| PCC  | Program Core Courses                              |
| PEC  | Program Elective Courses                          |
| MDM  | Multidisciplinary Minor                           |
| OE   | Open Elective                                     |
| VSEC   | Vocational and Skill Enhancement Course           |
| VSC  | Vocational Skill Courses                          |
| SEC  | Skill Enhancement Courses                         |
| AEC  | Ability Enhancement Course                        |
| EEMC   | Entrepreneurship, Economics and Management Course |
| IKS  | Indian Knowledge System                           |
| VEC  | Value Education                                   |
| RM   | Research Methodologies                            |
| CEFP   | Community Engagement or Field Project             |
| ELC  | Experiential Learning Courses                     |
| PRJ  | Project   |
| INT  | Internship  |
| CC   | Cocurricular Courses                              |
| DM   | Double Minor                                      |
| HR   | Honors with Research                              |

**Credit Specification:**

- ❖ Theory: 1 credit=13 to 15 hrs of teaching
- ❖ Lab: 1 Credit=26 to 30 hrs of lab work
- ❖ Studio Activities: 1 Credit= 26 to 30 hrs of creative activities
- ❖ Workshop Based Activities: 1 Credit=26 to 30 hrs of hands-on activities related to vocation/professional practice/skill based
- ❖ Seminar/Group Discussion: 1 Credit=13 to 15 hrs of participation
- ❖ Internship: 1 Credit=Per 2 weeks OR 36 to 40 hrs of engagement
- ❖ Field Based Learning/Practices: 1 Credit=26 to 30 hrs of learning activities
- ❖ Community Engagement Projects: 1 Credit=26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.



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**Credit requirements for different options of the Degrees:**

| Degree/SEM   | I  | II        | III       | IV        | V         | VI        | VII        | VIII       | Total |
|--|----|-----------|-----------|-----------|-----------|-----------|------------|------------|-------|
| <b>B.Tech with Multidisciplinary Minor</b>                                     | 20 | 20        | 22        | 22        | 22        | 22        | 20         | 20         | 168   |
| <b>B.Tech with Double Minor (Multidisciplinary &amp; Specialisation Minor)</b> | 20 | 20<br>+2* | 22<br>+4* | 22<br>+4* | 22<br>+4* | 22<br>+4* | 20<br>+2\$ | 20<br>+2\$ | 188   |
| <b>B.Tech with Research and Multidisciplinary Minor</b>                        | 20 | 20<br>+2* | 22<br>+4* | 22<br>+4* | 22<br>+4* | 22<br>+4* | 20<br>+2\$ | 20<br>+2\$ | 188   |

*\*Optional Credits      \$ optional 2 credits can be earned either in VII or VIII Semester*

1. Learners who earn a minimum of total **168 credits** will be awarded "**B.Tech in Engg. /Tech. with Multidisciplinary Minor (MDM)**" degree.

2. Learners will have the following options to earn **B. Tech. in Engg. /Tech. degree in**

- a. **Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor)**
- b. **Honors with Research and Multidisciplinary Minor**

***There is 2 credit course 'Introduction to Emerging Technologies' in SEM-II introducing various emerging technologies along with basics of various tracks under multidisciplinary, minor and research domain helping student in decision making for further options of learning.***

a) **Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor) (additional 20 credits):  $168 + 18 + 2$  (SEM-II)=188 Min Credits.**

There will be four courses (4 credits each), one in each semester starting from the 3rd semester which will be from emerging areas of specialisation. In 7<sup>th</sup> or 8<sup>th</sup> semester students will complete 2 credits seminar/project. **Admission eligibility min CGPA=7.5 after First year**

b) **B.Tech in Engg./ Tech.- Honors with Research and Multidisciplinary Minor (additional 20 credits by research):  $168 + 18 + 2$  (SEM-II)=188 Min Credits. (Admission eligibility min CGPA=7.5 after First and should maintain CGPA=7.5 after Third year)**

3. Learner can earn the certificate/Diploma/Degree based on his/her exit from the program as follows. College shall explore feasibility to offer NSDC aligned skill based courses to the learners:

- a. **UG Certificate:** After a one-year (40 credits to be earned) and 8-credits summer workshop/vocational courses/internship
- b. **UG Diploma:** After two-years (80 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project
- c. **B. Voc.:** After three-years (120 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project



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**Salient Features of Curriculum:**

- ✓ Framed as per Government Resolution dated 4<sup>th</sup> July 2023 in line with National Education Policy (NEP) 2020.
- ✓ Minimum 165 choice-based credit structure with options of Degrees earning additional credits
- ✓ Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning environment having bridge connecting verticals providing unique path for each learner for 3-dimensional growth, Life Long Learning, multiple entry-exit, inclusive model indicating equal distribution of central resources
- ✓ More emphasis on laboratory based and experiential learning
- ✓ More weightage to continuous assessment to reduce examination stress
- ✓ Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework
- ✓ Well balanced curriculum to attain Program Outcomes and skills of 21<sup>st</sup> century learner
- ✓ Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.
- ✓ Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21<sup>st</sup> Century



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**SEMESTERWISE CURRICULUM STRUCTURE**

**UG Computer Engineering Program:**

| Course Code | Course Vertical | Sub-Vertical | Course Name                                |       | Contact Hours              | Examination Marks (1 Credit=50 Marks) |     |      |     |       | Credits |       |
|-------------|-----------------|--------------|--|-------|----------------------------|---------------------------------------|-----|------|-----|-------|---------|-------|
|             |                 |              |  |       |                            | ISE1                                  | MSE | ISE2 | ESE | Total | Points  | Total |
| 25BSC11ME01 | BSESC           | BSC          | Matrices and Differential Calculus         |       | TH                         | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |
|             |                 |              |  |       | TU                         | 1                                     | 20  | -    | 30  | -     | 50      | 1     |
| 25BSC11ME04 | BSESC           | BSC          | Engineering Chemistry                      |       | TH                         | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |
|             |                 |              |  |       | PR                         | 2                                     | 20  | -    | 30  | -     | 50      | 1     |
| 25ESC11ME03 | BSESC           | ESC          | Programming Fundamentals                   |       | TH                         | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |
|             |                 |              |  |       | TU                         | 1                                     | 20  | -    | 30  | -     | 50      | 1     |
|             |                 |              |  |       | PR                         | 2                                     | 20  | -    | 30  | -     | 50      | 1     |
| 25PCC11ME03 | PCPEC           | PCC          | Basic Manufacturing Process                |       | TH                         | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |
|             |                 |              |  |       | PR                         | 2                                     | 20  | -    | 30  | -     | 50      | 1     |
| 25PCC11ME01 | PCPEC           | PCC          | Innovation and Design Thinking             |       | PR                         | 2                                     | 20  | -    | 30  | -     | 50      | 1     |
| 25PCC11ME04 | PCPEC           | PCC          | Essential Psychomotor Skills for Engineers |       | PR                         | 4                                     | 50  | -    | 50  | -     | 100     | 2     |
| 25PCC11ME02 | PCPEC           | PCC          | Essential Computing Skills for Engineers   |       | PR                         | 4                                     | 50  | -    | 50  | -     | 100     | 2     |
| 25IKS11ME01 | HSSM            | IKS          | Indian Knowledge System                    |       | TH                         | 2                                     | 50  | -    | 50  | -     | 100     | 2     |
|             |                 |              |  | Total | TH:TU:P<br>R<br>10:2:16=28 |                                       |     |      |     | 1000  | -       | 20    |

| Course Code | Course Vertical | Sub-Vertical | Course Name                                  |       | Contact Hours          | Examination Marks (1 Credit=50 Marks) |     |      |     |       | Credits |       |  |  |  |
|-------------|-----------------|--------------|--|-------|------------------------|---------------------------------------|-----|------|-----|-------|---------|-------|--|--|--|
|             |                 |              |  |       |                        | ISE1                                  | MSE | ISE2 | ESE | Total | Points  | Total |  |  |  |
| 25BSC11ME03 | BSESC           | BSC          | Integral Calculus and Probability Theory     |       | TH                     | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |  |  |  |
|             |                 |              |  |       | TU                     | 1                                     | 20  | -    | 30  | -     | 50      | 1     |  |  |  |
| 25BSC11ME02 | BSESC           | BSC          | Engineering Physics                          |       | TH                     | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |  |  |  |
|             |                 |              |  |       | PR                     | 2                                     | 20  | -    | 30  | -     | 50      | 1     |  |  |  |
| 25ESC11ME01 | BSESC           | ESC          | Engineering Graphics                         |       | TH                     | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |  |  |  |
|             |                 |              |  |       | PR                     | 2                                     | 20  | -    | 30  | -     | 50      | 1     |  |  |  |
| 25ESC11ME04 | BSESC           | ESC          | Human Health Systems                         |       | TH                     | 1                                     | 50  | -    | -   | -     | 50      | 1     |  |  |  |
| 25ESC11ME02 | BSESC           | ESC          | Basic Electrical and Electronics Engineering |       | TH                     | 2                                     | 20  | 30   | 20  | 30    | 100     | 2     |  |  |  |
|             |                 |              |  |       | TU                     | 1                                     | 20  | -    | 30  | -     | 50      | 1     |  |  |  |
|             |                 |              |  |       | PR                     | 2                                     | 20  | -    | 30  | -     | 50      | 1     |  |  |  |
| 25VSE11ME02 | SC              | VSEC         | Creative Coding in Python                    |       | PR                     | 4                                     | 50  | -    | 50  | -     | 100     | 2     |  |  |  |
| 25VSE11ME01 | SC              | VSEC         | Measuring Instruments and Testing Tools      |       | PR                     | 4                                     | 50  | -    | 50  | -     | 100     | 2     |  |  |  |
| 25AEC11ME01 | HSSM            | AEC          | Art of Communication                         |       | TH                     | 1                                     |     |      |     |       | 1       |       |  |  |  |
|             |                 |              |  |       | PR                     | 2                                     | 40  | -    | 60  | -     | 100     | 1     |  |  |  |
|             |                 |              |  | Total | TH:TU:PR<br>10:1:16=28 |                                       |     |      | -   | -     | 1100    | -     |  |  |  |
|             |                 |              |  |       |                        |                                       |     |      |     |       |         | 20    |  |  |  |

\* Introduced as first course for DM/HR

**NOTE:** Kindly refer-

1. 'Manual for Degree Options' for List of Courses offered under MDM and DM Degree options.



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| Course Code | Course Name                        | Teaching Scheme<br>(Hrs/week) |             |            | Credits Assigned |            |              |       |  |  |
|-------------|------------------------------------|-------------------------------|-------------|------------|------------------|------------|--------------|-------|--|--|
|             |                                    | L                             | T           | P          | L                | T          | P            | Total |  |  |
| 25BSC11ME01 | Matrices and Differential Calculus | 2                             | 1           | 0          | 2                | 1          | 0            | 3     |  |  |
|             |                                    | <b>Examination Scheme</b>     |             |            |                  |            |              |       |  |  |
|             |                                    |                               | <b>ISE1</b> | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |  |  |
|             |                                    | Theory                        | 20          | 30         | 20               | 30         | 100          |       |  |  |
|             |                                    | Tutorial                      | 20          | --         | 30               | --         | 50           |       |  |  |
|             |                                    |                               |             |            |                  |            |              |       |  |  |

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | Implement diagonalization of a given matrix using eigen values and eigen vectors.     |
|                            | CO2 | Execute Higher order derivatives of a given functions                                 |
|                            | CO3 | Apply partial differentiation technique to obtain the extremum of the given function. |
|                            | CO4 | Demonstrate basic knowledge of analytic functions in solving engineering problems.    |

| Module No. | Unit No.     | Topics   | Ref.    | Hrs.      |
|------------|--------------|--|---------|-----------|
| 1          | <b>Title</b> | <b>Matrices</b>  | 1,2,3,4 | <b>09</b> |
|            | <b>1.1</b>   | <b>Introduction:</b> Types of Matrices (symmetric, skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and their properties).<br>Rank of a Matrix using Echelon forms, reduction to normal form. |         | 02        |
|            | <b>1.2</b>   | System of Linear equations, their consistency and solutions.   |         | 02        |
|            | <b>1.3</b>   | Eigenvalues and Eigenvectors of a square matrix and their properties(without proof)  |         | 02        |
|            | <b>1.4</b>   | Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials   |         | 02        |
|            | <b>1.5</b>   | Similarity of matrices, diagonalizable and non-diagonalizable matrices   |         | 01        |
| 2          | <b>Title</b> | <b>Successive Differentiation</b>  | 1,2,3,4 | <b>03</b> |
|            | <b>2.1</b>   | Successive differentiation: nth derivative of standard functions.  |         | 02        |
|            | <b>2.2</b>   | Leibnitz's Theorem (without proof) and problems  |         | 01        |
| 3          | <b>Title</b> | <b>Partial Differentiation</b>   | 1,2,3,4 | <b>06</b> |
|            | <b>3.1</b>   | Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function.  |         | 03        |



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|              |              |  |                |           |
|--------------|--------------|--|----------------|-----------|
|              | <b>3.2</b>   | Euler's Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler's Theorem.<br>Maxima and Minima of a function of two independent variables,    |                | <b>03</b> |
| <b>4</b>     | <b>Title</b> | <b>Analytic Functions</b>  | <b>1,2,3,4</b> | <b>08</b> |
|              | <b>4.1</b>   | Function $f(z)$ of complex variable, Limit, Continuity and Differentiability of $f(z)$ , Analytic function: Necessary and sufficient conditions for $f(z)$ to be analytic (without proof). |                | 02        |
|              | <b>4.2</b>   | Cauchy-Riemann equations in Cartesian coordinates (without proof).   |                | 02        |
|              | <b>4.3</b>   | Milne-Thomson method: Determine analytic function $f(z)$ when real part (u), imaginary part (v) or its combination $au+ bv$ is given.  |                | 02        |
|              | <b>4.4</b>   | Harmonic function, Harmonic conjugate and Orthogonal trajectories.   |                | 02        |
| <b>Total</b> |              |  |                | <b>26</b> |

**Tutorial**

| <b>Exp. No.</b> | <b>Tutorial Details</b>    |
|-----------------|----------------------------|
| <b>1</b>        | Matrices                   |
| <b>2</b>        | Successive Differentiation |
| <b>3</b>        | Partial Differentiation    |
| <b>4</b>        | Analytic Functions         |
| <b>5</b>        | Matlab / Scilab Practical  |
| <b>6</b>        | Matlab / Scilab Practical  |
| <b>7</b>        | Matlab / Scilab Practical  |
| <b>8</b>        | Matlab / Scilab Practical  |

**Course Assessment:**

**Theory:**

**ISE-1:** MCQ: 20 Marks

**ISE-2:** MCQ: 20 Marks

**MSE:** 90 minutes 30 Marks written examination based on 50% syllabus

**ESE:** 90 minutes 30 Marks written examination based on the syllabus after MSE

**Tutorial:**

**1. ISE-1** will be conducted for the first two tutorials. (20 marks).

**2. ISE-2** will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks).



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**Recommended Books:**

- [1] Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4<sup>nd</sup> Edition.
- [2] H. K. Das, "*Advanced Engineering Mathematics*", S. Chand, 28<sup>th</sup> Edition.
- [3] Erwin Kreyszig, "*Advanced Engineering Mathematics*", John Wiley & Sons, 10<sup>th</sup> Edition.
- [4] Jain and Iyengar, "*Advanced Engineering Mathematics*", Narosa Publications, 4<sup>th</sup> Edition.



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| Course Code | Course Name           | Teaching Scheme (Hrs/week) |             |            | Credits Assigned |            |              |       |  |  |
|-------------|-----------------------|----------------------------|-------------|------------|------------------|------------|--------------|-------|--|--|
|             |                       | L                          | T           | P          | L                | T          | P            | Total |  |  |
| 25BSC11ME04 | Engineering Chemistry | 2                          | --          | 2          | 2                | --         | 1            | 3     |  |  |
|             |                       | <b>Examination Scheme</b>  |             |            |                  |            |              |       |  |  |
|             |                       |                            | <b>ISE1</b> | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |  |  |
|             |                       | Theory                     | 20          | 30         | 20               | 30         | 100          |       |  |  |
|             |                       | Lab                        | 20          | --         | 30               | --         | 50           |       |  |  |

**Pre-requisite Course Codes** --

|                 |     |   |
|-----------------|-----|---|
| Course Outcomes | CO1 | To evaluate the activity and selectivity of the catalyst  |
|                 | CO2 | To compare the different types renewable sources of energy  |
|                 | CO3 | To compare the different types of corrosion and control measures in industries.                         |
|                 | CO4 | To determine the quality of fuel and quantify the oxygen required for combustion of fuel.               |
|                 | CO5 | To evaluate the different types of fabrication methods,conducting polymers in various industrial fields |

| Module No. | Unit No. | Topics  | Ref.  | Hrs.     |
|------------|----------|---|-------|----------|
| 1          | Title    | <b>Catalysis</b>  | 1,2,4 | <b>5</b> |
|            |          | Basic concepts of catalysis (Homogeneous and Heterogeneous catalysis), Industrial applications of Catalysis-Oxidation-Hydroformylation, Reduction-Hardening of vegetable oils, Wilkinson's catalyst-Hydrogenation, Vaska's complex – Carbonylation, Commercial catalytic reactors (fixed bed, fluidized bed).   |       |          |
| 2          | Title    | <b>Energy resources (Solar, Hydel, Thermal etc.)</b><br>Introduction to Energy Sources, Solar Energy Basics, Solar Thermal Systems, Wind Energy, Geothermal Energy, Energy from Ocean: Principle of tidal power, components of Tidal Power Plant (TPP), classification, advantages and limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, types of OTEC power generation, block diagram, applications, advantages and limitations.   | 1,2,4 | <b>5</b> |
| 3          | Title    | <b>Corrosion</b><br>Definition, Mechanism of Corrosion –<br>(I) Dry or Chemical Corrosion - i) Due to oxygen ii) Due to other gases.<br>(II) Wet or Electrochemical corrosion - Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen.<br>Types of Corrosion - Galvanic cell corrosion, Concentration cell corrosion (differentialaeration principle),<br>Factors affecting the rate of corrosion -<br>(i) Nature of metal, (ii) Nature of corroding environment. Methods of corrosion control –<br>(I) Material selection and proper designing,<br>(II) Cathodic protection -<br>i) Sacrificial anodic protection ii) Impressed current method,<br>(III) Metallic coatings -only Cathodic coating (tinning) and anodic coatings (Galvanising) | 1,2,4 | <b>5</b> |



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|          |              |  |       |          |
|----------|--------------|--|-------|----------|
| <b>4</b> | <b>Title</b> | <b>Fuels and combustion</b><br>Definition, classification, characteristics of a good fuel, units of heat (no conversions). Calorific value - Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values. Solid fuels - Analysis of coal - Proximate and Ultimate Analysis - numerical problems and significance. Combustion - Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels. | 1,2,4 | <b>6</b> |
| <b>5</b> | <b>Title</b> | <b>Polymers</b><br>Molecular weight (Number average and weight average), Numericals problems on molecular weight, Effect of heat on the polymers (Glass transition temperatures), Viscoelasticity, Conducting polymers, Classification-Thermoplastic and Thermosetting polymers, Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion molding, Preparation, properties and uses of PMMA, Butyl Rubber, PTFE and Kevlar   | 1,2,4 | <b>5</b> |

| <b>Exp. No.</b> | <b>List of Experiments</b>   |
|-----------------|--|
| <b>1</b>        | To determine the emf of a given cell potentiometrically.                                       |
| <b>2</b>        | To determine the moisture and Ash content in the given fuel sample.                            |
| <b>3</b>        | To determine the percentage of volatile matter of a given sample by steam distillation method. |
| <b>4</b>        | To determine the COD value of a given sample.  |
| <b>5</b>        | To determine the pH value of a given sample.   |
| <b>6</b>        | To Remove hardness of water by ion-exchange method.  |
| <b>7</b>        | To determine the cobalt ion concentration by colorimetry method.                               |
| <b>8</b>        | To determine the conductance of a given sample   |

**Course Assessment:**

**Theory:**

**ISE-1:**

Activity: Quiz and assignments 20 Marks

**ISE-2:** Two hours 20 Marks

Activity: Article Discussion, Quiz and Assignments

Outcome: Reflective Journal

**MSE:** 90 minutes **30 Marks** written examination based on 50% syllabus

**ESE:** 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

**Lab:**

**ISE:**

**1. ISE-1** will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

**2. ISE-2**

- a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
- b. Reflective journal analysis on the given problem statement for 10 marks



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**Recommended Books:**

- [1] Engineering Chemistry - Jain & Jain, Dhanpat Rai
- [2] Engineering Chemistry – Dara & Dara, S Chand
- [3] Green Chemistry: A textbook – V.K.Ahluwalia, Alpha Science International
- [4] A Text Book of Engineering Chemistry – Shashi Chawla, DhanpatRai
- [5] Textbook of Qualitative Inorganic Analysis: A. I. Vogel



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| Course Code | Course Name              | Teaching Scheme (Hrs/week) |      |     | Credits Assigned |   |     |       |
|-------------|--------------------------|----------------------------|------|-----|------------------|---|-----|-------|
|             |                          | L                          | T    | P   | L                | T | P   | Total |
| 25ESC11ME03 | Programming Fundamentals | 2                          | 1    | 2   | 2                | 1 | 1   | 4     |
|             |                          | Examination Scheme         |      |     |                  |   |     |       |
|             |                          |                            | ISE1 | MSE | ISE 2            |   | ESE | Total |
|             |                          | Theory                     | 20   | 30  | 20               |   | 30  | 100   |
|             |                          | TU                         | 20   | --  | 30               |   | --  | 50    |
|             |                          | Lab                        | 20   | --  | 30               |   | --  | 50    |

| Pre-requisite Course Codes |     |  |
|----------------------------|-----|--|
| Course Outcomes            | CO1 | Explain the problem solving aspects using various programming paradigms.                                     |
|                            | CO2 | Illustrate programming principles, decision making statements, looping constructs.                           |
|                            | CO3 | Demonstrate modular programming using functions  |
|                            | CO4 | Demonstrate the applications of derived data types such as arrays, pointers, strings and functions.          |
|                            | CO5 | Apply various C++ constructs such as classes, objects, static members, access specifiers                     |
|                            | CO6 | Apply the concept of inheritance to achieve code reusability and virtual functions for run time polymorphism |

| Module No. | Unit No. | Topics  | Ref. | Hrs. |
|------------|----------|---|------|------|
| 1          |          | <b>Introduction to Problem Solving</b>  | 1-2  | 2    |
|            | 1.1      | Steps for Problem Solving. Algorithm and FlowChart. Flow of Control.  |      |      |
|            | 1.2      | Imperative and Declarative Programming Paradigm.  |      |      |
| 2          |          | <b>C Programming Fundamentals</b>   | 1,2  | 4    |
|            | 2.1      | Variables, keywords, Data types, Operators: Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements. Operator Precedence and Expression evaluation. |      |      |
|            | 2.2      | Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement  |      |      |
|            | 2.3      | Iterative Structures: while, do-while, for, nested loops, Jump control statements.  |      |      |
| 3          |          | <b>Arrays</b>   | 1,2  | 4    |
|            | 3.1      | Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, standard String handling functions.                                       |      |      |
| 4          |          | <b>Functions and Pointer</b>  | 1,2  | 4    |
|            | 4.1      | Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, call by reference, Recursion   |      |      |
|            | 4.2      | Declaration and Access of Pointer variables, Pointer arithmetic,  |      |      |



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|              |  |     |           |
|--------------|--|-----|-----------|
|              | Pointer and Arrays.  |     |           |
| <b>5</b>     | <b>Fundamentals of Object Oriented Programming</b>   | 3,4 | 06        |
|              | <b>5.1</b> Declaration, Initialization, Array of Structure, pointer to structure.  |     |           |
|              | <b>5.2</b> Features of OOP, Classes and Objects, "this" pointer, Constructor and Destructors, static members.  |     |           |
|              | <b>5.3</b> Inline functions, Passing parameters to functions, Functions with default arguments   |     |           |
|              | <b>5.4</b> Access Specifiers, Friend Function and Friend Classes   |     |           |
| <b>6</b>     | <b>Inheritance and Polymorphism</b>  | 3,4 | 06        |
|              | <b>6.1</b> Types of Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance, Inheritance and Constructors |     |           |
|              | <b>6.2</b> Function Overloading, Operator Overloading.   |     |           |
|              | <b>6.3</b> Polymorphism, Virtual Functions, Pure Virtual Functions, Abstract Classes.  |     |           |
| <b>Total</b> |  |     | <b>26</b> |

|          | <b>Indicative Experiments</b>  |
|----------|--|
| <b>1</b> | Programs using Basic Control Structures, branching and looping.                        |
| <b>2</b> | Programs for the use of 1-D, 2-D arrays and String.                                    |
| <b>3</b> | Demonstrate the use of Functions with different types of parameter passing mechanisms. |
| <b>4</b> | Demonstrate the use of Pointers  |
| <b>5</b> | Program on Structures and pointer to Structure.  |
| <b>6</b> | Programs on basics of Object Oriented Programming Construct,                           |
| <b>7</b> | Program to demonstrate various categories Inheritance.                                 |
| <b>8</b> | Program to apply kinds of Polymorphism.  |

**Course Assessment:**

**Theory:**

**1. ISE-1: Quiz:** 10 marks.

**Assignments:** 10 marks

**2. ISE-2: Mini-Project:** 20 marks

**MSE:** 90 minutes **30 Marks** written examination based on 50% syllabus

**ESE:** 90- minutes **30 Marks** written examination based on remaining syllabus after MSE

**Tutorial: Need to add**

**Lab**

: **1. ISE-1** Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

**2. ISE-2**

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

b. Practical Exam: 10 marks

**(iii)Tutorial: (Minimum 10 Tutorials covering all modules)**

**ISE-1 for 20 Marks: Based on first 04 Tutorials of 5 marks each**

**ISE-2 for 30 Marks : Based on remaining tutorials (Minimum 6 tutorials)**



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| Week No.             | Topic   |
|----------------------|---|
| 1 <sup>st</sup> Week | <p>Write Algorithm and Draw Flowchart for following problem statements</p> <ol style="list-style-type: none"> <li>1. Fahrenheit and Celsius.</li> <li>2. Gross salary.</li> <li>3. Sum of three digit nos.</li> <li>4. Swapping two nos.</li> <li>5. A divisible by B using ternary op.</li> <li>6. Largest of three using ternary.</li> </ol> <p>Home Assignment:</p> <p>Write Algorithm and Draw Flowchart for following problem statements</p> <ol style="list-style-type: none"> <li>1. Simple Interest</li> <li>2. Given an integer number in seconds as input, print the equivalent time in hours, minutes and seconds as output (Ex 7322 seconds is equivalent to 2 hrs 2 mins 2 secs)</li> <li>3. Accept a number and display its equivalent ASCII number.</li> </ol> |
| 2 <sup>nd</sup> week | <ol style="list-style-type: none"> <li>1. Roots of Quadratic equation</li> <li>2. Leap year</li> <li>3. Largest of three nos. using nested if ..else</li> <li>4. Type of triangle using else if ladder</li> <li>5. Electricity Bill using if else if ladder</li> <li>6. Vowels using switch case</li> </ol>   |
| 3 <sup>rd</sup> week | <ol style="list-style-type: none"> <li>1. Factorial using for loop</li> <li>2. A <math>\wedge</math> B using for</li> <li>3. Fibonacci series using for</li> <li>4. Series: <math>1 + 1/3 + 1/5 \dots</math></li> <li>5. Series: <math>1 - 1/3 + 1/5 \dots</math></li> <li>6. Series: <math>1 - \frac{1}{2!} + \frac{1}{3!} - \frac{1}{4!}</math></li> </ol>  |
| 4 <sup>th</sup> week | Patterns  |
| 5 <sup>th</sup> Week | <ol style="list-style-type: none"> <li>1. Sum of digits of a number</li> <li>2. Reversing a number</li> <li>3. Armstrong number</li> <li>4. Binary to Dec</li> <li>5. Dec to Binary</li> <li>6. nPr and nCr</li> </ol>  |
| 6 <sup>th</sup> Week | <ol style="list-style-type: none"> <li>1. Fibonacci using recursion</li> <li>2. <math>X^Y</math> using recursion</li> <li>3. GCD using recursion</li> <li>4. Reversing a number using recursion</li> <li>5. Printing binary form of a decimal no. using recursion (Home Assignment)</li> <li>6. Maximum of an array</li> <li>7. Sorting an array using bubble sort</li> <li>8. Sum of array of size 'n' using recursion</li> </ol>  |
| 7 <sup>th</sup> Week | <ol style="list-style-type: none"> <li>1. Reversing an array</li> <li>2. Binary search</li> <li>3. Clockwise rotation (optional)</li> <li>4. Sum of each row and column of a matrix</li> <li>5. Transpose of a matrix</li> <li>6. Symmetric Matrix</li> </ol>   |
| 8 <sup>th</sup> Week | <p>Strings:</p> <ol style="list-style-type: none"> <li>1. Convert first letter of every word into uppercase</li> <li>2. String copy without using library functions</li> <li>3. Returning average of an array by passing array to fun</li> <li>4. Reverse a string by passing string to function</li> </ol>   |



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|                       |   |
|-----------------------|---|
|                       |   |
| 9 <sup>th</sup> Week  | 1. Printing details of the patients with a given decease using structure.<br>2. Adding two complex numbers using structure.<br>3. One program to clear basics of pointer (optional) |
| 10 <sup>th</sup> Week | Pointers  |
| 11 <sup>th</sup> week | friend class and friend function<br>1) Rectangle and Square Relationship<br>2) Complex Number Operations  |
| 12 <sup>th</sup> week | concept of class and object:<br>1) Student Record<br>2) Bank Account<br>3) Library Management   |
| 13 <sup>th</sup> Week | function overloading<br>1) Calculate Area<br>2) Currency Converter<br>3) Volume Calculator  |

**Recommended Books:**

- [1] Yashavant Kanetkar, "Let Us C", BPB publication, Sixteenth Edition
- [2] V. Rajaraman & Neeharika Adabala, "Computer Programming in C" PHI Learning, Eastern Economy Edition, Second Edition.
- [3] K.R. Venugopal, Rajkumar, T. Ravishankar, "Mastering C++" ,Tata McGraw Hill, Second Edition.
- [4] Herbert Schildt, " C++:Complete Reference" , Tata McGraw Hill, Fourth Edition,



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| Course Code | Course Name                   | Teaching Scheme<br>(Hrs/week) |      |     | Credits Assigned |     |              |       |
|-------------|-------------------------------|-------------------------------|------|-----|------------------|-----|--------------|-------|
|             |                               | L                             | T    | P   | L                | T   | P            | Total |
| 25PCC11ME03 | Basic Manufacturing Processes | 2                             | --   | 2   | 2                | --  | 1            | 3     |
|             |                               | <b>Examination Scheme</b>     |      |     |                  |     |              |       |
|             |                               |                               | ISE1 | MSE | ISE2             | ESE | <b>Total</b> |       |
|             |                               | Theory                        | 20   | 30  | 20               | 30  | 100          |       |
|             |                               | Lab                           | 20   | --  | 30               | --  | 50           |       |

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | Identify and differentiate between various manufacturing processes.                       |
|                            | CO2 | Explain the function of the basic parts of the machine tools and its accessories.         |
|                            | CO3 | Analyse various machining processes and select the particular process for a specific job. |
|                            | CO4 | Calculate machining time for various manufacturing processes.                             |

### Part A (Theory)

| Module No. | Unit No. | Topics  | Ref | Hrs. |
|------------|----------|---|-----|------|
| 1          |          | <b>Introduction to the various manufacturing processes.</b>   | 1,2 | 03   |
|            | 1.1      | Definition and need of various manufacturing processes.   |     |      |
|            | 1.2      | Classification of various manufacturing processes based on chip-less and chip-removal processes.          |     |      |
| 2          |          | <b>Cutting off machines</b>   | 1,2 | 02   |
|            | 2.1      | Types of circular saws, Band saw, Power hacksaw, Friction saw, Abrasive cutting off machines.             |     |      |
|            | 2.2      | Advantages, Limitations, and Applications of different types of cutting off machines.                     |     |      |
| 3          |          | <b>Lathe machine</b>  | 1,2 | 08   |
|            | 3.1      | Descriptions and functions of lathe parts. Lathe specifications, Lathe operations, and Taper turning.     |     |      |
|            | 3.2      | Turning parameters like speed, feed, depth of cut, and metal removal rate. Calculation of machining time. |     |      |
|            | 3.3      | Single point cutting tool nomenclature. Work and tool holding devices & accessories.                      |     |      |
|            | 3.4      | Types of Lathe machines including Capstan and Turret Lathe. Boring operation.                             |     |      |
| 4          |          | <b>Drilling machine</b>   | 1,2 | 04   |
|            | 4.1      | Drilling operations. Types of Drilling machines.  |     |      |
|            | 4.2      | Drill nomenclature. Work and tool holding devices. Calculation of machining time in drilling.             |     |      |
|            | 4.3      | Deep hole drilling and Boring machines.   |     |      |
| 5          |          | <b>Milling machine</b>  | 1,2 | 05   |
|            | 5.1      | Types of milling operations and their difference. Milling parameters.                                     |     |      |
|            | 5.2      | Types of milling machines. Types of Milling cutters.  |     |      |



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|              |            |  |     |           |
|--------------|------------|--|-----|-----------|
|              | <b>5.3</b> | Special milling attachments and accessories. Calculation of machining time in milling. |     |           |
| <b>6</b>     |            | <b>Grinding machine</b>  | 1,2 | 04        |
|              | <b>6.1</b> | Principle of grinding. Types of grinding machines and operations.                      |     |           |
|              | <b>6.2</b> | Grit, grade, and structure of grinding wheels. Balancing of grinding wheels.           |     |           |
|              | <b>6.3</b> | Truing, dressing, and shaping of grinding wheels.                                      |     |           |
| <b>Total</b> |            |  |     | <b>26</b> |

**Course Assessment:**

**Theory:**

**ISE-1:**

Activity: A visit will be arranged for students in a workshop (other than CRCE) to get a demonstration on Lathe, Drilling, and Milling machines. Students will submit a report as part of ISE-1 based on their observation of their visit. (20 Marks)

**ISE-2:**

Activity: An Industrial Visit will be organized to a production facility where students will be able to gain more knowledge of the various machine tools. Students will submit a report as part of ISE-2 based on their observation of their industrial visit. (20 Marks)

**MSE:** 90 minutes **30 Marks** written examination based on 50% syllabus

**ESE:** 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

**Lab:**

**Part B (Lab)**

|              | <b>Activities to be completed during lab time</b>  | <b>Ref.</b> | <b>Hrs.</b> |
|--------------|--|-------------|-------------|
| A1           | Visit to Fr. CRCE workshop (Demonstration of Lathe, Drilling, Milling, and Shaping machines) and report writing. | 1,2         | 12          |
| A2           | Calculation of machining time (Lathe, Drilling and Milling operation).   | 1,2         | 6           |
| A3           | Draw and label a lathe machine.  | 1,2         | 2           |
| A4           | Draw and label any one type of drilling machine.   | 1,2         | 2           |
| A5           | Draw and label the single-point cutting tool.  | 1,2         | 2           |
| A6           | Draw and label the drill nomenclature.   | 1,2         | 2           |
| <b>Total</b> |  |             | <b>26</b>   |



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**Course Assessment:-**  
**(Lab)**

**ISE:**

1. **ISE-1** will be conducted for two activities (A1 and A2) Continuous pre-defined rubrics-based evaluation for 20 marks.
2. **ISE-2** will be conducted for four activities (A3, A4, A5, A6) Continuous pre-defined rubrics-based evaluation for 30 marks.

**Recommended Books:**

**Text Books:**

- [1] Elements of Workshop Technology: Machine Tools (Volume – 2) by S. K. Hajra Choudhary, K. Hajra Choudhary, Nirjhar Roy, Media promoters 15 th Edition (2023).
- [2] A Course in Workshop Technology Vol. II (Machine Tools) by B. S. Raghuwanshi, Dhanpat Rai & Co. (2015).

**Reference Books:**

- [3] Manufacturing, Engineering and Technology, 5th Edition by Serope Kalpakjian, Steven R. Schmid, Pearson (2018).
- [4] A Text Book of Production Technology Vol. II by O. P. Khanna, Dhanpat Rai Publication (2012).

**AICTE Prescribed Textbook:**

Manufacturing Engineering, (Based on Model Curriculum of AICTE) - Santosh Kumar, All India Council for Technical Education, Feb 2023

(<https://ekumbh.aicte-india.org/allbook.php#>)



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| Course Code | Course Name                    | Teaching Scheme<br>(Hrs/week) |      |                    | Credits Assigned |     |       |       |
|-------------|--------------------------------|-------------------------------|------|--------------------|------------------|-----|-------|-------|
|             |                                | L                             | T    | P                  | L                | T   | P     | Total |
| 25PCC11ME01 | Innovation and Design Thinking | --                            | --   | 2                  | --               | --  | 1     | 1     |
|             |                                |                               |      | Examination Scheme |                  |     |       |       |
|             |                                |                               | ISE1 | MSE                | ISE2             | ESE | Total |       |
|             |                                | Theory                        | --   | --                 | --               | --  | --    |       |
|             |                                | Lab                           | 20   | --                 | 30               | --  | 50    |       |
|             |                                |                               |      |                    |                  |     |       |       |

| Pre-requisite Course Codes |  |
|----------------------------|--|
|                            | At the end of the course the students will be able                         |
| Course Outcomes            | CO1 To discuss case studies of innovative products and services.           |
|                            | CO2 To identify the market needs and customer demand analysis.             |
|                            | CO3 To generate ideas through brainstorming and frame product/service idea |
|                            | CO4 To empathize with the customer.  |
|                            | CO5 To design and develop a prototype.                                     |
|                            | CO6 To pitch their idea.   |

| Module No. | Unit No. | Topics   | Ref. | Hrs. |
|------------|----------|--|------|------|
| 1          |          | <p><b>Innovation and Creativity:</b><br/> <b>(Takeaway)</b><br/>           Innovation, Invention and Creativity. Mindset. Convergent and Divergent Thinking. Case Studies – levels and types of Innovations. Market Impact. Linear and Non-Linear Innovations.</p> <p><b>(Key Exercises)</b></p> <ol style="list-style-type: none"> <li>1. Exercises/Games/Activities to boost creativity and Inspiration</li> <li>2. Article/Case Studies Discussion</li> <li>3. Digital Market Survey Report and Customer Demand Analysis, Preparing competencies report to identify desired level of innovation &amp; domain definition.</li> </ol> |      | 04   |
| 2          |          | <p><b>Introduction of Design Thinking:</b><br/> <b>(Takeaway)</b><br/>           Five stage model of design thinking. Empathize, Define, Ideate, Prototype, Testing. Non-linearity of the Model.</p> <p><b>(Key Exercises)</b></p> <ol style="list-style-type: none"> <li>1. Live examples and videos</li> <li>2. Design Thinking Activity for given problem</li> <li>3. Find the impact and value of Innovation</li> </ol>  |      | 04   |
| 3          | 3.1      | <p><b>Empathize:</b><br/> <b>(Takeaway)</b><br/>           Empathize with users. Step into the customer's shoes. Ask right questions. What? Why? Empathy Map. Draw inference from research.</p>  |      | 04   |



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|              |     |   |  |           |
|--------------|-----|---|--|-----------|
|              |     | <b>(Key Exercises)</b><br>1. Immersion Activity-Body Storming.<br>2. Finding the user needs in the market by using Social, Physical, Identity, Communication, Emotional (SPICE) Framework<br>3. Creation of Empathy Map, Affinity Map, Mind Map, Journey Map<br>4. Story Telling, K-Scripts for case study, Role Playing  |  |           |
| 4            | 4.1 | <b>Definition and Ideation:</b><br><b>(Takeaway)</b><br>Idea Generation, Themes, Thinking for refinement, Storytelling and Tools for Innovation<br><b>(Key Exercises)</b><br>1. Brainstorming, Sketch<br>2. Situation, Constraints, Objectives, People, Estimates and Scope (SCOPES) tool<br>3. Social, Technology, Economy, Environment and Political (STEEP) trend analysis for opportunity framing by using steep matrix template.<br>4. Defining the strategic priorities of customer demand and stakeholder mapping<br>5. Generating new ideas with Substitute, Combine, Adapt, Magnify/Minify, Reverse, Eliminate, put to other use (SCAMPER) tool. |  | 04        |
| 5            | 5.1 | <b>Prototyping:</b><br>Prototyping, Testing for Desirable, Feasible and viable solution, Product Market Fit, Business Model validation<br><b>(Takeaway)</b><br><b>(Key Exercises)</b><br>1. Value Proposition Canvas<br>2. Business Model canvas  |  | 06        |
| 6            |     | <b>The Design Challenge:</b><br><b>(Takeaway)</b><br>Define Design Challenge, Prototyping Iteration, Pitching, Media<br><b>(Key Exercises)</b><br>1. Demo day   |  | 04        |
| <b>Total</b> |     |   |  | <b>26</b> |



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**Course Assessment:**

**Lab:**

**ISE:**

1. ISE-1 will be conducted for first three experiments. (Article discussion, Design thinking workshop for a sample idea, Empathy Map)  
Continuous pre-defined rubrics-based evaluation for 20 marks.
2. **ISE-2**
  - a. Idea Competition. Continuous pre-defined rubrics-based evaluation for 10 marks.
  - b. Business Model Canvas for identified Idea for 10 marks
  - c. Demo Day – Prototype for 10 marks

**Recommended Books:**

1. Prof. Bala Ramadurai, "Karmic Design Thinking", ISBN-13 January 2020.
2. Idris Mootee, "Design Thinking For Strategic Innovation: What They Can't Teach You at Business or Design School", 2013, Wiley Publications.
3. Christoph Meinel, Larry Leifer, Hasso Plattner, "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4. Roger Martin, "The Design of Businesses: Why Design Thinking is the next Competitive Advantage", Harward Business Press, 2009

**Referenced Books:**

- [1] Peter F. Drucker, "Innovation and Entrepreneurship", Routledge.
- [2] Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 2009 HarperBusiness.
- [3] Blake Masters, Peter Thiel, "Zero to One: Notes on Start Ups, or How to Build the Future"
- [4] Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" 2011 Penguin
- [5] Andrew King, Jeanne Liedtka, Kevin Bennett, "Solving Problems with Design Thinking: Ten Stories of What Works", Columbia Business School Publishing, 2013.
- [6] Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, "Design Thinking: Business Innovation Kindle Edition", MJV Press 2011
- [7] Robert A. Burgelman, Clayton M. Christensen, Steven C. Wheelwright, "Strategic Management of Technology and Innovation", McGraw-Hill, 2017, 5<sup>th</sup> Edition.

**Online Courses:**

<https://www.classcentral.com/course/youtube-design-thinking-transforming-teams-110078>  
<https://www.coursera.org/learn/uva-darden-design-thinking-innovation>  
<https://www.coursera.org/learn/creative-thinking-techniques-and-tools-for-success>  
<https://www.coursera.org/specializations/uva-darden-design-thinking-learning.edx.org>: Design Thinking and Creativity for Innovation



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| Course Code | Course Name                                | Teaching Scheme<br>(Hrs/week) |    |      | Credits Assigned |      |     |       |
|-------------|--|-------------------------------|----|------|------------------|------|-----|-------|
|             |  | L                             | T  | P    | L                | T    | P   | Total |
|             |  | --                            | -- | 4    | --               | --   | 2   | 2     |
| 25PCC11ME04 | Essential Psychomotor skills for engineers | Examination Scheme            |    |      |                  |      |     |       |
|             |  |                               |    | ISE1 | MSE              | ISE2 | ESE | Total |
|             |  | Theory                        | -- | --   | --               | --   | --  | --    |
|             |  | Lab                           | 50 | --   | 50               | --   | 100 |       |

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | use skill of writing texts, labels, drawing perspective images and creating 3D objects with technical drawing fundamentals. |
|                            | CO2 | build solid model of a given object using 3D modeling software.   |
|                            | CO3 | identify and rectify computer hardware and networking related issues  |
|                            | CO4 | perform soldering and de-soldering of discrete components on Universal PCB  |
|                            | CO5 | install, configure and operate system admin servers.  |

| Module No. | Unit No. | Topics  | Ref.    | Hrs.      |
|------------|----------|---|---------|-----------|
| 1          |          | <b>Creative Art</b>   |         | <b>8</b>  |
|            | 1.1      | Art of writing Cursive, Bold, Italic, Block (3D) lettering, Creating Designer Name-Plates, Labels, Visiting Cards   | [1]     | 4         |
|            | 1.2      | Introduction to Perspective Views, Iso-Scale and True Scale Isometrics, Construction of 3D regular blocks like Prism, Cylinder, Cut sections, Frustum (Card Paper model) using Development of Surface method. | [1]     | 4         |
| 2          |          | <b>Introduction to solid modeling</b>   |         | <b>12</b> |
|            | 2.1      | Solid Modeling 3D Geometric modeling of an Engineering component, demonstrating modeling skills using commands like Extrude, Revolve, Sweep, Blend, Loft etc.   | [2,3]   | 12        |
| 3          |          | <b>Computer hardware, networking and troubleshooting</b>  |         | <b>10</b> |
|            | 3.1      | Computer assembly and troubleshooting   | [4]     | 2         |
|            | 3.2      | IP address configuration, basic networking commands such as ping, netstat, traceroute, understand functionality of a network switch   | [5,6]   | 2         |
|            | 3.3      | Implementation of LAN (2-3 computers) using network switch  | [7]     | 2         |
|            | 3.4      | Identify and troubleshoot basic network problems using networking commands such as ping, netstat and traceroute   | [8,9]   | 4         |
| 4          |          | <b>PCB making and soldering</b>   |         | <b>12</b> |
|            | 4.1      | Soldering and de-soldering practice on Universal PCB using discrete components.   | [10,11] | 4         |
|            | 4.2      | Implementation of a 3V power supply circuit (using transistors and Zener diode) on Universal PCB  | [12]    | 8         |
| 5          |          | <b>Types of servers and their usage</b>   |         | <b>10</b> |
|            | 5.1      | Configuration and working of web server, FTP server   | [13,14] | 4         |



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|              |            |  |         |           |
|--------------|------------|--|---------|-----------|
|              | <b>5.2</b> | Configuration and working of NFS server, SSH server  | [15,16] | 4         |
|              | <b>5.3</b> | Configuration and working of a wireless access point | [17]    | 2         |
| <b>Total</b> |            |  |         | <b>52</b> |

**Course Assessment:**

**Lab:**

**ISE:**

**1. ISE-1**

- a. Assignment on Module 1 for 20 marks
- b. Assignment on Module 2 for 20 marks
- c. Group activity on (network troubleshooting) Module 3 for 10 marks

**2. ISE-2**

- a. Quiz on Module 4 for 10 marks
- b. Assignment (PCB implementation) on Module 4 for 30 marks
- c. Group activity on Module 5 for 10 marks

**Recommended References**

- [1] <https://mixeeva-design.ru/media/content/the-art-of-calligraphy.pdf>
- [2] N.D. Bhatt, *Machine Drawing*, Chartor Publishing
- [3] Alexander Bordino, *Autodesk Inventor 2023 cookbook*, Packt publishing
- [4] <https://bskillforum.bharatskills.gov.in/DashBoardUpload/Others-EBOOK-28Oct2022131021.pdf>
- [5] <https://rsydigitalworld.com/15-useful-linux-networking-commands/>
- [6] <https://www.pearsonhighered.com/assets/samplechapter/0/7/8/9/0789732548.pdf>
- [7] <https://www.youtube.com/watch?v=CGeAauny2fc>
- [8] <https://pcpl21.org/wp-content/uploads/2020/09/10-Troubleshooting-Tips-If-Your-Internet-Is-Connected-But-Not-Working.pdf>
- [9] <https://www.youtube.com/watch?v=AimCNTzDlVo>
- [10] Schwartz, Mel, ed. *Soldering: Understanding the basics*. ASM International, 2014.
- [11] Hamilton, Charles. *A guide to printed circuit board design*. Elsevier, 2013.
- [12] <https://www.circuits-diy.com/3v-1a-dc-supply-using-bd135-139-npn-transistor/>
- [13] <https://www.digitalocean.com/community/tutorials/how-to-install-the-apache-web-server-on-ubuntu-20-04>
- [14] <https://itslinuxfoss.com/how-to-install-an-ftp-server-on-ubuntu-22-04/>
- [15] <https://ubuntu.com/server/docs/service-nfs>
- [16] <https://www.cyberciti.biz/faq/ubuntu-linux-install-openssh-server/>
- [17] <https://www.youtube.com/watch?v=CEfUsyc2lwg>



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| Course Code        | Course Name | Teaching Scheme (Hrs/week)                      |    |            | Credits Assigned |            |              |       |  |
|--------------------|-------------|---|----|------------|------------------|------------|--------------|-------|--|
|                    |             | L   | T  | P          | L                | T          | P            | Total |  |
|                    |             | --  | -- | 4          | --               | --         | 2            | 2     |  |
| <b>25PCC11ME02</b> |             | <b>Essential Computing skills for engineers</b> |    |            |                  |            |              |       |  |
|                    |             | <b>Examination Scheme</b>                       |    |            |                  |            |              |       |  |
|                    |             | <b>ISE1</b>                                     |    | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |  |
|                    |             | Theory  | -- | --         | --               | --         | --           |       |  |
|                    |             | Lab   | 50 | --         | 50               | --         | 100          |       |  |

**Pre-requisite Course Codes**

|                        |     |   |
|------------------------|-----|---|
| <b>Course Outcomes</b> | CO1 | use Linux commands to perform file operations.      |
|                        | CO2 | use Matlab/ Scilab for scientific computing.        |
|                        | CO3 | use web technology to design web pages.             |
|                        | CO4 | perform CRUD operations using relational databases. |
|                        | CO5 | create scientific document using LaTeX.             |
|                        | CO6 | perform data analysis using spreadsheet.            |
|                        |     |   |

| Module No. | Unit No.   | Topics  | Ref. | Hrs.      |
|------------|------------|---|------|-----------|
| 1          |            | <b>Introduction to Linux Operating System</b>   | [1]  | <b>08</b> |
|            | <b>1.1</b> | Demonstration of installation of Linux Operating System   | [1]  | 2         |
|            | <b>1.2</b> | Linux command prompt usage, Use of man command, Linux directory structure, finding present working directory in Linux, listing files and directories with different options, changing the directory, creating files and directories using Linux commands    | [1]  | 2         |
|            | <b>1.3</b> | Deleting files with rm, deleting folder with -d & -r, moving files and folders with mv, renaming with mv, copying with cp, use of cat command, the wc command, the sort command, Redirection in Linux, Introduction to piping, use of nano and/or vi editor | [1]  | 2         |
|            | <b>1.4</b> | Use of locate and find commands, Use of Grep in Linux, use of chmod and chown for giving permissions in Linux   | [1]  | 2         |
| 2          |            | <b>Introduction to Scientific Computing using Matlab/ Scilab</b>  | [2]  | <b>10</b> |
|            | <b>2.1</b> | Introduction to Matlab/Scilab, getting data into Matlab/Scilab, creating, concatenating and reshaping arrays, Accessing data in arrays, mathematical and statistical operations with arrays   | [2]  | 2         |
|            | <b>2.2</b> | Taking user input, control structures for making decisions and adapting to different situations, conditional data selection   | [2]  | 2         |
|            | <b>2.3</b> | Visualizing data using 2D and 3D plots, introduction to toolboxes for different scientific computing tasks, creating and calling functions  | [2]  | 2         |
|            | <b>2.4</b> | Introduction to tables of data, storing and sorting table data, extracting data from table, exporting tables, combining tables, [2]indexing into cell arrays, Working with date and time  | [2]  | 2         |
|            | <b>2.5</b> | Preprocessing data- normalizing data, working with missing data   | [2]  | 2         |
| 3          |            | <b>Foundations of web technology</b>  | [3]  | <b>10</b> |



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|  |            |  |     |   |
|--|------------|--|-----|---|
|  | <b>3.1</b> | HTML Basics- HTML tags and attributes, Headings in HTML, creating paragraphs in HTML, Basic formatting tags of HTML, | [3] | 2 |
|--|------------|--|-----|---|

|          |  |   |     |           |
|----------|--|---|-----|-----------|
|          |  | giving background and font colors using HTML, creating links using HTML, Adding images in HTML  |     |           |
|          | <b>3.2</b>                                 | Creating tables and lists using HTML, creating forms in HTML, Embedding videos on web page  | [3] | 2         |
|          | <b>3.3</b>                                 | CSS syntax, CSS selectors, background formatting using CSS, CSS box model, adding borders, margins and padding using CSS, adding styles to fonts using CSS, Positioning using CSS, Pseudo-classes in CSS, CSS navigation bar, creating image gallery using CSS, use of external CSS for creating website layout | [3] | 2         |
|          | <b>3.4</b>                                 | Introduction to Javascript, basic Javascript syntax, Variables in Javascript, operators and control structures in Javascript, functions in Javascript, arrays and number handling in Javascript,  | [3] | 2         |
|          | <b>3.5</b>                                 | DOM manipulation in Javascript, Form validation using Javascript  | [3] | 2         |
| <b>4</b> | <b>Introduction to Database Technology</b> |   | [4] | <b>02</b> |
|          | <b>4.1</b>                                 | Installation of MySQL/Postgresql, creating database schema and tables, DML operations, conditional selection of records from the database tables, demonstration of PHP-MySQL/Postgresql database connectivity   | [4] | 2         |
| <b>5</b> | <b>Introduction to LaTeX</b>               |   | [5] | <b>12</b> |
|          | <b>5.1</b>                                 | Demonstration of installation and usage of Texlive/MikeTex, formatting words, lines and paragraphs, font formatting, creating section and subsections, use of geometry package  | [5] | 2         |
|          | <b>5.2</b>                                 | Insertion of graphics and tables in document, creation of lists, mathematics environment, writing equations   | [5] | 2         |
|          | <b>5.3</b>                                 | Writing algorithms, inserting code in document, creating table of contents, creating hyperlinks   | [5] | 2         |
|          | <b>5.4</b>                                 | Bibliography management, citations, creating chapters using report class, inserting other .tex and .pdf files in document   | [5] | 2         |
|          | <b>5.5</b>                                 | Presentation in LaTeX using beamer class, creating overlay in beamer, blocks in beamer presentation, presentation themes  | [5] | 2         |
|          | <b>5.6</b>                                 | Usage of style files in a document  | [5] | 2         |
| <b>6</b> | <b>Data analysis using spreadsheet</b>     |   | [6] | <b>10</b> |
|          | <b>6.1</b>                                 | Introduction to Microsoft Excel/Open office Calc/Google Sheets, functionality using ranges, use of formulae for basic data analysis (sum, average, if, count, min, max, proper, upper, lower, autosum), sorting, filter, text to column, data validation  | [6] | 2         |
|          | <b>6.2</b>                                 | Use of advance formulae for data analysis (concatenate, vlookup, hlookup, match, countif, text, trim)   | [6] | 2         |
|          | <b>6.3</b>                                 | Creating pivot tables, manipulating pivot table, usage of pivot table tool bar, changing data field properties, displaying a pivot chart, setting pivot table options, adding subtotals to pivot tables   | [6] | 2         |
|          | <b>6.4</b>                                 | Data visualization- creating 2D and 3D plots  | [6] | 2         |
|          | <b>6.5</b>                                 | Data visualization using conditional formatting- creating formula-based rules   | [6] | 2         |



|              |           |
|--------------|-----------|
| <b>Total</b> | <b>52</b> |
|--------------|-----------|

### **Course Assessment:**

#### **ISE:**

##### **1. ISE-1**

- a. Quiz based on module 1 for 10 marks.
- b. Completion of any 4 courses from suggested list on module 2 for 20 marks.

Suggested URL and course list:

<https://matlabacademy.mathworks.com/>

1. MATLAB Onramp
2. Simulink Onramp
3. App Building Onramp
4. Object-Oriented Programming Onramp
5. Simscape Onramp
6. Circuit Simulation Onramp

- c. Quiz based on module 2 for 10 marks.
- d. Assignment (web page designing) based on module 3 for 10 marks.

##### **2. ISE-2**

- a. Quiz based on module 4 for 10 marks.
- b. Assignment (Scientific Document Preparation using LaTeX) based on module 5 for 20 marks.
- c. Assignment (data analysis using spreadsheet) based on module 6 for 20 marks.

### **Recommended References:**

- [1] <https://ubuntu.com/tutorials?topic=desktop>
- [2] <https://in.mathworks.com/support/learn-with-matlab-tutorials.html>
- [3] <https://www.w3schools.com/>
- [4] <https://www.mysql.com/>
- [5] <https://en.wikibooks.org/wiki/LaTeX>
- [6] <https://support.microsoft.com/en-us/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb>



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| Course Code | Course Name             | Teaching Scheme<br>(Hrs/week) |      |     | Credits Assigned |     |       |       |
|-------------|-------------------------|-------------------------------|------|-----|------------------|-----|-------|-------|
|             |                         | L                             | T    | P   | L                | T   | P     | Total |
| 25IKS11ME01 | Indian Knowledge System | 2                             | --   | --  | 2                | --  | --    | 2     |
|             |                         | Examination Scheme            |      |     |                  |     |       |       |
|             |                         |                               | ISE1 | MSE | ISE2             | ESE | Total |       |
|             |                         | Theory                        | 50   | --  | 50               | --  | 100   |       |
|             |                         | Lab                           | --   | --  | --               | --  | --    |       |

| Pre-requisite Course Codes -- |     |   |
|-------------------------------|-----|---|
| Course Outcomes               | CO1 | Enumerate the main characteristics of education system in Vedic and post Vedic period to enrich the intellectual imagination          |
|                               | CO2 | Review the ancient discovery and research in Indian number system and ancient Indian mathematics                                      |
|                               | CO3 | Review the contribution from Ancient Indian system to astronomy and metallurgy  |
|                               | CO4 | Trace the significant developments in Indian engineering and technology in Irrigation, painting, surgical techniques and shipbuilding |
|                               | CO5 | Cultivate a deep sense of identity and pride in enriched scientific Indian heritage   |

| Module No.   | Unit No. | Topics   | Ref. | Hrs.      |
|--------------|----------|--|------|-----------|
| 1            | 1.1      | What is Indian Knowledge System (IKS)? Why do we need it?<br>Salient aspects of IKS.   | 1    | 2         |
|              | 1.2      | The Vedic Corpus: Introduction to Vedas, Sub-classification of Vedas, Messages in Vedas, Vedic Life: A Distinctive Features  | 1    | 3         |
| 2            | 2.1      | Number systems in India, Measurements for time, distance, and weight, Bhūta-Saṃkhyā system, Katapayādi system, Piṅgala and the Binary system   | 1    | 4         |
|              | 2.2      | Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry and Trigonometry  | 1    | 4         |
| 3            | 3.1      | Indian contributions in astronomy, The celestial coordinate system, Elements of the Indian calendar, Notion of years and months, Indian Astronomical Instruments                                     | 1    | 4         |
|              | 3.2      | Wootz Steel, Mining and ore extraction, Metals and Metalworking Technology, Iron and steel in India, Lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components | 1    | 4         |
| 4            | 4.1      | Irrigation systems and practices in South India, Dyes and painting technology, Surgical techniques, Shipbuilding   | 1    | 3         |
|              | 4.2      | Temple architecture in India, Perspective of Arthaśāstra on town planning.   | 1    | 2         |
| <b>Total</b> |          |  |      | <b>26</b> |



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**Course Assessment:**

**ISE-1:** Quiz: 20Marks (Two 10 marks each)

Activity: Group Discussion on Indian Knowledge System: 10 Marks

Activity: Creative Activity: 20 Marks

**ISE-2:** Quiz: 20 Marks (Two 10 marks each)

Activity: Reflection discussion on Indian Knowledge System: 10 Marks

Activity: Creative Activity: 20 Marks

**Recommended Books:**

- [1] B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R. N., "*Introduction to Indian Knowledge System: Concepts and Applications*" PHI, 2022
- [2] Kapil Kapoor, Avadhesh K. Singh, "*Indian Knowledge Systems, Volume I*", Indian Institute of Advanced Study, 2005
- [3] R. P. Kulkarni, "*Glimpses of India Engineering and Technology: Ancient and Medieval Period*," Munshiram Manoharlal Publishers Pvt. Ltd., 2018



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| Course Code               | Course Name                              | Teaching Scheme<br>(Hrs/week) |     |      | Credits Assigned |              |     |
|---------------------------|--|-------------------------------|-----|------|------------------|--------------|-----|
|                           |  | L                             | T   | P    | L                | T            | P   |
| 25BSC11ME03               | Integral Calculus and Probability Theory | 2                             | 1   | 0    | 2                | 1            | 0   |
| <b>Examination Scheme</b> |  |                               |     |      |                  |              |     |
|                           |  | ISE1                          | MSE | ISE2 | ESE              | <b>Total</b> |     |
|                           |  | Theory                        | 20  | 30   | 20               | 30           | 100 |
|                           |  | Tutorial                      | 20  | --   | 30               | --           | 50  |

| Pre-requisite Course Codes  |     |
|---|-----|
| Course Outcomes   | CO1 |
|   | CO2 |
|   | CO3 |
|   | CO4 |
| Execute first order linear differential equation.   |     |
| Execute higher order linear differential equation.  |     |
| Interpret the region of integration in solving double integrals.  |     |
| Apply concepts of probability and expectation for getting spread of the data and probability distributions. |     |

**Theory:**

| Module No. | Unit No. | Topics   | Ref.    | Hrs.      |
|------------|----------|--|---------|-----------|
| 1          | Title    | <b>Linear Differential Equations of first order</b>  | 1,2,3,4 | <b>06</b> |
|            | 1.1      | Exact Differential Equations, Integrating Factors, equations reducible to exact form.  |         | 03        |
|            | 1.2      | Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation   |         | 03        |
| 2          | Title    | <b>Linear Differential Equations of higher order</b>   | 1,2,3,4 | <b>07</b> |
|            | 2.1      | Linear differential equation with constant coefficient- complementary function, particular integrals of differential equation of the type $f(D)y = X$ where X is $e^{ax}$ , $\sin(ax+b)$ , $\cos(ax+b)$ , $x^m$ , $e^{ax}V$ , $xV$ , where V is a function of x. |         | 05        |
|            | 2.2      | Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.  |         | 02        |
| 3          | Title    | <b>Integral Calculus</b>   | 1,2,3,4 | <b>07</b> |
|            | 3.1      | Gamma functions: properties of gamma functions and integrals reducible to gamma functions.   |         | 01        |
|            | 3.2      | Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula.   |         | 02        |
|            | 3.3      | Tracing of curves (Standard curves, Cardioid, Lemniscate, Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes)   |         | 01        |
|            | 3.4      | Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form.  |         | 03        |
| 4          | Title    | <b>Probability</b>   | 1,2,3,4 | <b>06</b> |
|            | 4.1      | Definition and basics of probability, conditional probability.   |         | 01        |



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|              |            |   |  |           |
|--------------|------------|---|--|-----------|
|              | <b>4.2</b> | Total Probability theorem and Bayes' theorem.   |  | 01        |
|              | <b>4.3</b> | Discrete and continuous random variable with probability distribution and probability density function. |  | 02        |
|              | <b>4.4</b> | Expectation, Variance, Moment generating function, Raw and central moments up to 4 <sup>th</sup> order. |  | 02        |
| <b>Total</b> |            |   |  | <b>26</b> |

**Tutorial:**

| Exp. No. | Tutorial Details                              |
|----------|---|
| <b>1</b> | Linear Differential Equations of First Order  |
| <b>2</b> | Linear Differential Equations of Higher Order |
| <b>3</b> | Integral Calculus                             |
| <b>4</b> | Probability                                   |
| <b>5</b> | Matlab / Scilab Practical                     |
| <b>6</b> | Matlab / Scilab Practical                     |
| <b>7</b> | Matlab / Scilab Practical                     |
| <b>8</b> | Matlab / Scilab Practical                     |

**Course Assessment:**

**Theory:**

**ISE-1:** MCQ: 20 Marks

**ISE-2:** MCQ: 20 Marks

**MSE:** 90 minutes 30 Marks written examination based on 50% syllabus

**ESE:** 90 minutes 30 Marks written examination based on the syllabus after MSE

**Tutorial:**

**1. ISE-1** will be conducted for the first two tutorials. (20 marks).

**2. ISE-2** will be conducted for the remaining two tutorials (20 marks) and four Matlab / Scilab practical (10 marks).

**Recommended Books:**

- [1] Dr B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 4<sup>nd</sup> Edition.
- [2] H. K. Das, "Advanced Engineering Mathematics", S. Chand, 28<sup>th</sup> Edition.
- [3] Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10<sup>th</sup> Edition.
- [4] Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 4<sup>th</sup> Edition.



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| Course Code | Course Name         | Teaching Scheme (Hrs/week) |      |     | Credits Assigned |     |              |       |
|-------------|---------------------|----------------------------|------|-----|------------------|-----|--------------|-------|
|             |                     | L                          | T    | P   | L                | T   | P            | Total |
| 25BSC11ME02 | Engineering Physics | 2                          | --   | 2   | 2                | --  | 1            | 3     |
|             |                     | <b>Examination Scheme</b>  |      |     |                  |     |              |       |
|             |                     |                            | ISE1 | MSE | ISE2             | ESE | <b>Total</b> |       |
|             |                     | Theory                     | 20   | 30  | 20               | 30  | 100          |       |
|             |                     | Lab                        | 20   | --  | 30               | --  | 50           |       |
|             |                     |                            |      |     |                  |     |              |       |

**Pre-requisite Course Codes**

|                 |     |  |
|-----------------|-----|--|
| Course Outcomes | CO1 | Derive the conditions for intensity maximum and minimum in interference and diffraction of light and solve numerical problems. |
|                 | CO2 | Derive Schrodinger equation in time dependent and independent form and solve it for particle in a box problem.                 |
|                 | CO3 | Explain the working of lasers and optical fiber and their applications.  |
|                 | CO4 | Explain Fermi level and its variations in semiconductors and derive expression for Hall Effect.                                |
|                 | CO5 | Explain the Physical principles of sensors and their applications.   |
|                 |     |  |

| Module No. | Unit No. | Topics  | Ref. | Hrs. |
|------------|----------|---|------|------|
| 1          |          | <b>Wave Optics – Interference &amp; Diffraction</b>   | 1    | 6    |
|            | 1.1      | Theory of interference of light - Thin films- wedge shaped film, Newton's rings, Anti reflection coating.   |      |      |
|            | 1.2      | Fraunhofer diffraction at single slit – diffraction due to 'n' slits- plane transmission grating. Applications of grating.  |      |      |
| 2          |          | <b>Quantum Physics</b>  | 3    | 5    |
|            | 2.1      | Wave – particle duality-de Broglie matter waves – Concept of wave function and its physical significance – Heisenberg's Uncertainty Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one-dimensional rigid box.              |      |      |
| 3          |          | <b>Laser &amp; Fiber optics</b>   | 4,2  | 5    |
|            | 3.1      | Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser-spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state lasers (Nd-YAG), gas lasers (He-Ne, CO2), applications. |      |      |
|            | 3.2      | Optical fiber- principle [TIR]-types-material, mode, refractive index- Expression for acceptance angle and numerical aperture. Application-Communication.   |      |      |
| 4          |          | <b>Semiconductor Devices &amp; Applications</b>   | 6    | 5    |
|            | 4.1      | Fermi -Dirac Distribution Law, Fermi Level in intrinsic & Extrinsic semiconductors, Variation of Fermi level with doping and temperature. P-N Junction, Fermi Level in P-N Junction in biased and unbiased conditions. Hall Effect and its applications.                            |      |      |
| 5          |          | <b>Physics of Sensors</b>   | 7    | 5    |
|            | 5.1      | Resistive sensors:<br>a) Temperature measurement: PT100 construction, calibration, LM35.  |      |      |



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|              |     |   |  |    |
|--------------|-----|---|--|----|
|              |     | b) Thermocouples: concept, calibration, and application of J -type and K-type thermocouple<br>c) Humidity measurement using resistive sensors   |  |    |
|              | 5.2 | Pressure sensor: Concept of pressure sensing by capacitive, flex and inductive method, Analog pressure sensor: construction working and calibration and applications.   |  |    |
|              | 5.3 | Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement, liquid and air velocity measurement.         |  |    |
|              | 5.4 | Optical sensor: Photodiode, construction and use of photodiode as ambient light measurement and flux measurement.<br>Pyroelectric sensors: Construction and working principle, application of pyroelectric sensor as bolometer. |  |    |
| <b>Total</b> |     |   |  | 26 |

**Course Assessment:**

**Theory:**

**ISE-1:**

Activity: Quiz and assignments 20 Marks

**ISE-2:** Two hours 20 Marks

Activity: Article Discussion, Quiz and Assignments

Outcome: Reflective Journal

**MSE:** 90 minutes **30 Marks** written examination based on 50% syllabus

**ESE:** 90 minutes **30 Marks** written examination based on remaining syllabus after MSE

**Lab:**

**ISE:**

**1. ISE-1** will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

**2. ISE-2**

- Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
- Simulation using modern tools to solve the given problem statement for 10 marks

| Exp. No. | Experiment Details  |
|----------|---|
| 1        | P-N Junction: Forward & Reverse bias characteristics                    |
| 2        | Determination of Plank's constant by Photo electric cell method         |
| 3        | Determination of wavelength of Laser by diffraction grating             |
| 4        | Determination of Numerical aperture & acceptance angle of optical fiber |
| 5        | Determination of Radius of curvature of lens by Newton's rings          |
| 6        | Determination of thickness using air wedge apparatus                    |
| 7        | Determination of grating constant                                       |
| 8        | Determination of wavelengths of Mercury spectrum.                       |



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**Recommended Books:**

**TEXT BOOKS**

1. Optics by Subramaniam N & BrijLal, S Chand & Co. Pvt. Ltd., New Delhi,
2. Modern Physics by R Murugesan, Kiruthiga, Sivaprasath S Chand
3. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut.]
4. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications
6. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
7. Handbook of Modern Sensors Physics design and application- Jacob Fraden, Springer, AIP press.

**REFERENCE BOOKS**

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGraw Hill Inc., New Delhi,
2. Quantum Mechanics by V. Devanathan, Narosa, Chennai.
3. Engineering Physics by M.N. Avadhanulu, S. Chand & Company Ltd.
4. Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
5. Optics by R. Agarwal, S. Chand publishers.
6. Basic Electronics by B.L. Theraja, S. Chand publishers.
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.
8. Electronic Instrumentation – H.S. Kalsi, Tata Mc Graw-Hill Education
9. Instrumentation & Measurement Techniques by Albert D. Helfrick & William D. Cooper  
(PHI) Edition



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| Course Code  |                      | Course Name | Teaching Scheme<br>(Hrs/week) |                    |     | Credits Assigned |       |       |  |
|--------------|----------------------|-------------|-------------------------------|--------------------|-----|------------------|-------|-------|--|
| L            | T                    |             | P                             | L                  | T   | P                | Total |       |  |
| 25ESCI11ME01 | Engineering Graphics |             |                               |                    |     |                  |       |       |  |
|              |                      |             |                               | Examination Scheme |     |                  |       |       |  |
|              |                      |             |                               | ISE1               | MSE | ISE2             | ESE   | Total |  |
|              |                      | Theory      | 20                            | 30                 | 20  | 30               | 100   |       |  |
|              |                      | Lab         | 20                            | --                 | 30  | --               | 50    |       |  |
|              |                      |             |                               |                    |     |                  |       |       |  |

**Part A (Theory)**

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | To draw Projection of Points, Lines and Planes  |
|                            | CO2 | To draw projections in Projection of solids   |
|                            | CO3 | To draw sectional views in Section of solids and draw the development of lateral surfaces of solids with sections |
|                            | CO4 | To apply the basic principles of projections in converting 3D view to 2D drawing.                                 |
|                            | CO5 | To visualize an object from the given two views   |
|                            | CO6 | To use Computer Aided Drafting tools for drawing various views including Isometric Views                          |

| Module No. | Unit No. | Topics   | Ref. | Hrs. |
|------------|----------|--|------|------|
| 1          | 1.1      | <b>Introduction to Engineering Graphics</b><br>Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions. Introduction to plain and diagonal scales. | 1,4  | 1    |
|            | 1.2      | <b>Engineering Curves</b><br>Basic construction of Cycloid, Involutes and Helix (of cylinder) only.  | 1,4  | 2    |
| 2          | 2.1      | <b>Projection of Points and Lines</b><br>Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application based problems on Projection of lines.   | 1,4  | 3    |
|            | 2.2      | <b>Projection of Planes</b><br>Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes).  | 1,4  | 1    |
|            | 2.3      | <b>Projection of Solids</b><br>(Prism, Pyramid, Cylinder, Cone only) Solid projection with the axis inclined to HP and VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method | 1,4  | 3    |



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|              |            |   |       |           |
|--------------|------------|---|-------|-----------|
|              | <b>2.4</b> | <b>Section of Solids</b><br>Section of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane (Exclude Curved)   | 1,4   | 3         |
|              |            | Section Plane). Use change of position or Auxiliary plane method.   |       |           |
| 3            | <b>3.1</b> | <b>Orthographic:</b> - Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts                   | 1,4   | 3         |
|              | <b>3.2</b> | <b>Sectional Orthographic Projections</b><br>Full or Half Sectional views of the Simple Machine parts   | 2,4   | 3         |
| 4            | <b>4.1</b> | <b>Isometric Views:</b> - Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views(Excluding Sphere ).  | 1,2,4 | 3         |
|              | <b>4.2</b> | <b>Missing Views:</b> The identification of missing views from the given views. Create the third view from the two available views so that all the details of the object are obtained   | 1,2,4 | 3         |
| 5            | <b>5.1</b> | <b>Development of Lateral Surfaces</b><br>Lateral surface development of Prism, Pyramid, Tetrahedron, Hexahedron, Cylinder, Cone with section plane inclined to HP or VP only. (Exclude DLS of a solid with a hole in it and Reverse Development) | 1,4   | 3         |
| <b>Total</b> |            |   |       | <b>28</b> |

**Course Assessment:**

**Theory:**

**ISE-1:**

Team Activity: Two Hours Duration: 20 Marks

Making Models out of Card Boards/Clay for Basic Primitive solids. Solids will be cut by Section plane as per instructions provided Drawing Projections of Same as per instructions will be part of activity. Here Cut sections will also be developed using development principles. There will be small quiz or students will give a demonstration of Project or activity

Assessment will be done by two teachers in the department who are teaching engineering graphics

**ISE-2:** Two hours 20 Marks

Team Activity

Here One Simple component either machine component/Any simple component will be given to group of students in team. Students will measure dimensions and make working drawing of same showing all three views/sectional views including isometric view. At the end of activity Group will give presentation on same

**MSE:** 90 minutes **30 Marks** written examination based on 50% syllabus

**ESE:** 90 minutes **30 Marks** written examination based on remaining syllabus after MSE



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**Lab:**

**Part B (Lab)**

| <b>To be Taught in laboratory</b>   |   |             |             |
|---|---|-------------|-------------|
|   | <b>Topics</b>   | <b>Ref.</b> | <b>Hrs.</b> |
| 1   | <b>Overview of Computer Graphics Covering:</b><br>Listing the computer technologies that impact on graphical communication ,demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable),The Status Bar, Different methods of zoom as used in CAD, Select and erase objects. | 3           | 3           |
| 2   | <b>Customization &amp; CAD Drawing:</b><br>Consisting of set up of the drawing page and the printer including scale settings,Setting up of units and drawing limits, ISO and ANSI standards for coordinate dimensioning.  | 3           | 3           |
| 3   | <b>Annotations, layering &amp; other Functions Covering:</b><br>Applying dimensions to objects, applying annotations to drawings, Setting up and use of layers, layers to create drawings, Create, edit and use customized layers, Changing line lengths through modifying existing lines (extend/lengthen),Printing documents to paper using the print command, orthographic projection techniques, Drawing sectional views of objects (simple machine parts).   | 3           | 3           |
| Activities to be Completed in CAD Lab                                     |   |             |             |
| A1  | Orthographic Projection (1 Problem)   | 3           | 4           |
| A2  | Sectional Orthographic Projection (1 Problem)   | 3           | 4           |
| A3  | Reading of Orthographic Projections (1 Problem)   | 3           | 3           |
| A4  | Isometric Views (2 Problems)  | 3           | 3           |
| Activities to be completed on A3 Size Sketchbook using Conventional Tools |   |             |             |
| A6  | Projection of Solids (1 Problem)  | 1,4         | 2           |
| A7  | Sections of Solids and Development of Lateral Surfaces (2 Problems)   | 1,4         | 2           |
| A8  | Sectional Orthographic Views (1 Problem)  | 1,4         | 2           |
|   | Total   |             | 29          |

**Course Assessment:- (Lab)**

- 1. ISE-1** will be conducted for four activities (A1,A2,A3,A4) Continuous pre-defined rubrics-based evaluation for 20 marks.
- 2. ISE-2** will be conducted for four activities (A5,A6,A7,A8) Continuous pre-defined rubrics-based evaluation for 30 marks.



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**Recommended Books:**

- [1] N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd
- [2] N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
- [3] Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "( CAD Soft Technologies ) :Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi
- [4] Dhananjay A Jolhe, Engineering Drawing, Tata McGraw Hill.



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| Course Code | Course Name          | Teaching Scheme<br>(Hrs/week) |    |            | Credits Assigned |            |              |       |
|-------------|----------------------|-------------------------------|----|------------|------------------|------------|--------------|-------|
|             |                      | L                             | T  | P          | L                | T          | P            | Total |
| 25ESC11ME04 | Human Health Systems | 1                             | -- | --         | 1                | --         | --           | 1     |
|             |                      | <b>Examination Scheme</b>     |    |            |                  |            |              |       |
|             |                      | <b>ISE1</b>                   |    | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |
|             |                      | Theory                        | 20 | --         | 30               | --         | 50           |       |
|             |                      | Lab                           | -- | --         | --               | --         | --           |       |

| Pre-requisite Course Codes |     | Basic Science   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | Familiarize the students with the basic biological concepts and their engineering applications. |
|                            | CO2 | Understand bio-design principles to create novel devices and structures in the future           |
|                            | CO3 | Develop the interdisciplinary vision of biological engineering                                  |

| Module No. | Unit No.     | Topics   | Ref. | Hrs. |
|------------|--------------|--|------|------|
| 1          | <b>Topic</b> | <b>Significance of Biology in Engineering</b>  |      | 2    |
|            | 1.1          | Introduction, Aspects of Biology as an Independent scientific discipline   |      |      |
|            | 1.2          | Biological observations of the 18 <sup>th</sup> Century that led to major discoveries, Brownian motion, Origin of Thermodynamics concerning original observations of Robert Brown and Julius Mayer |      |      |
|            | 1.3          | Fundamental importance of observation in any scientific inquiry  |      |      |
| 2          | <b>Topic</b> | <b>Human Organ Systems and Bio Designs – 1</b>   |      | 4    |
|            | 2.1          | Brain as a CPU System, Architecture of the human brain as a CPU system- Comparison between Brains Computing System with Conventional Von Neumann Computing System                                  |      |      |
|            | 2.2          | Central Nervous System (CNS) and Peripheral Nervous System (PNS)-2 types: Somatic and Autonomic, Signal Transmission   |      |      |
|            |              | EEG (Electroencephalography- Applications, EEG Signals and Types of Brain Activity)  |      |      |
|            | 2.3          | Robotic Arms for Prosthetics- Robotic Arm Prosthetic Direct Control through Muscle Signals (myoelectric control), Robotic Arm Prosthetic by Brain-Machine Interfaces                               |      |      |
|            | 2.4          | Parkinson's disease<br>Engineering Solutions for Parkinson's Disease   |      |      |
|            | 2.5          | Artificial Brain   |      |      |
|            | 2.6          | Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye)   |      |      |
|            | 2.7          | Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart-related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators)        |      |      |



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|              |       |   |           |
|--------------|-------|---|-----------|
| 3            | Topic | <b>Human Organ Systems and Bio Designs – 2</b>  | 3         |
|              | 3.1   | Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology – COPD(Chronic obstructive pulmonary disease), Ventilators, Heart-lung machine) |           |
|              | 3.2   | Kidney as a filtration system (architecture, mechanism of filtration, Chronic Kidney Disease, dialysis systems)   |           |
| 4            | Topic | <b>Nature-Bioinspired Materials And Mechanisms</b>  | 2         |
|              | 4.1   | Echolocation (ultrasonography, sonars),   |           |
|              | 4.2   | Photosynthesis (photovoltaic cells, bionic leaf).   |           |
|              | 4.3   | Lotus leaf effect (Super hydrophobic and self-cleaning surfaces),   |           |
|              | 4.4   | Plant burrs (Velcro)  |           |
|              | 4.5   | Kingfisher beak (Bullet train)  |           |
|              | 4.6   | Shark skin (Friction reducing swimsuits)  |           |
|              | 4.7   | Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and Perfluorocarbons (PFCs)  |           |
| 5            | Topic | <b>Trends in Bioengineering</b>   | 2         |
|              | 5.1   | Bioprinting techniques and materials,   |           |
|              | 5.2   | 3D printing of ear, bone, and skin. 3D printed foods,   |           |
|              |       | Electrical tongue, and electrical nose in food science,   |           |
|              | 5.3   | DNA origami and Biocomputing,   |           |
|              | 5.4   | Bioimaging and Artificial Intelligence for disease diagnosis.   |           |
|              | 5.5   | Self-healing Bio concrete (based on bacillus spores, calcium lactate nutrients, and biominerilization processes)  |           |
|              | 5.6   | Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, and Arsenic)  |           |
| <b>Total</b> |       |   | <b>13</b> |

**ISE Marks**

1. **ISE1-1 Quiz/ Assignment** = 20 Marks
2. **ISE2-1 Quiz/ Assignment** = 10 Marks
3. **Presentation / Poster Making** = 20 Marks

**Suggested Learning Resources:**

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.



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- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
- Blood Substitutes, Robert Winslow, Elsevier, 2005

**Web links and Video Lectures (e-Resources):**

- <https://nptel.ac.in/courses/121106008>
- <https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists>
- <https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009>
- <https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006>
- <https://www.coursera.org/courses?query=biology>
- <https://www.classcentral.com/subject/biology>
- <https://www.futurelearn.com/courses/biology-basic-concepts>



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| Course Code | Course Name   | Teaching Scheme<br>(Hrs/week) |             |            | Credits Assigned |            |   |              |  |
|-------------|---|-------------------------------|-------------|------------|------------------|------------|---|--------------|--|
|             |   | L                             | T           | P          | L                | T          | P | Total        |  |
| 25ESC11ME02 | <b>Basic Electrical and Electronics Engineering</b> | 2                             | --          | 2          | 2                | --         | 1 | 3            |  |
|             |   | Examination Scheme            |             |            |                  |            |   |              |  |
|             |   |                               | <b>ISE1</b> | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> |   | <b>Total</b> |  |
|             |   | Theory                        | 20          | 30         | 20               | 30         |   | 100          |  |
|             |   | Lab                           | 20          | --         | 30               | --         |   | 50           |  |

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| <b>Course Outcomes</b>     | CO1 | Apply various network theorems to analyze DC circuits.  |
|                            | CO2 | Analyze single phase and three phase AC circuits.   |
|                            | CO3 | Describe the constructional features and operation of single phase Transformer.                   |
|                            | CO4 | Illustrate the working principle and applications of DC machines.                                 |
|                            | CO5 | Explain the applications of P-N junction diode in rectifiers and filters for converting AC to DC. |

| Module No. | Unit No. | Topics   | Ref. | Hours |
|------------|----------|--|------|-------|
| 1          |          | <b>DC Circuits</b>   |      |       |
|            | 1.1      | Basic electrical quantities :- charge, current, voltage, power, and energy. Types of circuit elements: resistors, capacitors, and inductors. Ohm's Law and Kirchhoff's Laws. Types of sources  | 1,4  | 7     |
|            | 1.2      | D.C. circuits and network simplification: series and parallel circuits, star-delta transformation, Mesh and Nodal Analysis, Source transformation.   | 1,4  |       |
|            | 1.3      | DC Network Theorems: Superposition Theorem, Thevenin's Theorem, Maximum Power Transfer Theorem   | 1,4  |       |
| 2          |          | <b>AC Circuits</b>   |      |       |
|            | 2.1      | Generation of alternating voltage & current (AC), fundamentals of AC - waveforms, Phasor representation of AC quantities, definitions of time period, amplitude, frequency, phase, RMS value and average value, Peak factor and Form Factor. | 1,3  | 6     |
|            | 2.2      | R, L, C in AC circuits, Series RL, RC and RLC circuits- phase difference and power factor, phasor diagram, series-parallel circuits, active, reactive, apparent power, series resonance.   | 1,3  |       |
| 3          |          | <b>Three phase circuits</b>  |      |       |
|            | 3.1      | Three phase circuits: voltage and current generation, advantages and applications, voltages, currents and power in Star connected and delta connected balanced circuits.   | 2,3  | 4     |



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|     |  |     |  |
|-----|--|-----|--|
| 3.2 | Relationship between phase and line currents and voltages in Star and Delta connected systems, Phasor diagrams | 2,3 |  |
|-----|--|-----|--|

|              |  |  |       |  |
|--------------|--|--|-------|--|
| 5            | <b>Single phase transformer</b>  |  | 5     |  |
|              | <b>4.1</b> Construction, principle of operation, types of transformer, induced emf equation and transformation ratio.                                      |  |       |  |
|              | <b>4.2</b> Transformer at No load and Full load condition, phasor diagrams, equivalent circuit, Losses in transformer, Regulation and Efficiency.          |  |       |  |
| 5            | <b>DC machines</b>   |  |       |  |
|              | <b>5.1</b> Construction, principle of operation, classification of DC machines, applications of DC generator, DC motor, equation of generated emf/back emf |  | 3 2   |  |
| 6            | <b>Semiconductor Diodes</b>  |  |       |  |
|              | <b>6.1</b> Working of P-N junction Diode, I-V characteristic, application as a rectifier, and introduction to filters.                                     |  | 6,7 2 |  |
| <b>Total</b> |  |  | 26    |  |

**Course Assessment:**

**(i) Theory:**

**ISE-1 for 20 Marks:**

- (a) Tutorial on independent solving of numerical examples (10 marks) - 2 hours
- (b) Multiple choice questions (MCQ) - 10 marks (1 hour)

**ISE-2 for 20 Marks:**

- (a) Multiple choice questions (MCQ) - 10 marks (1 hour)
- (b) Circuit simulation for 10 marks

**MSE: 90 minutes 30 Marks written examination based on 50% syllabus**

**ESE: 90 minutes 30 Marks written examination based on remaining syllabus after MSE**

**(ii) Lab: 40 Marks (08 experiments of 05 marks each) + 10 Marks (activity based) = 50 Marks ISE:**

**1. ISE-1** will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

**2. ISE-2**

- a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
- b. Activity: Oral examination / viva-voce (10 marks) ISE-1:

**Proposed List of Laboratory Experiments:-**

1. Verification of Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification Maximum Power Transfer Theorem.
4. Measurement of electrical parameters for alternating sinusoidal voltage (AC)
5. To find resonance conditions in a R-L-C series resonance circuit
6. To measure relationship between phase and line, currents and voltages in three phase system
7. Forward & reverse bias characteristics of PN junction diode



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8. Application of PN junction diode – rectifiers (full-wave)

**Recommended Books:**

1. V. N. Mittal and Arvind Mittal – Basic Electrical Engineering, Tata McGraw Hill
2. B. L. Theraja – Textbook of Electrical Technology, Prentice Hall of India (PHI)
3. Kothari & Nagrath – Theory and Problems of Basic Electrical Engineering, PHI (13th edition)
4. B.R Patil – Basic Electrical Engineering, Oxford Higher Education
5. Principles of Electrical Engineering – Vincent Del Toro, Prentice Hall of India (PHI)
6. V. K. Mehta – Principles of Electronics, S. Chand Publishing, New Delhi
7. R. S. Sedha – A Textbook of Applied Electronics, S. Chand Publishing, New Delhi



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| Course Code | Course Name               | Teaching Scheme<br>(Hrs/week) |      |                    | Credits Assigned |     |       |       |
|-------------|---------------------------|-------------------------------|------|--------------------|------------------|-----|-------|-------|
|             |                           | L                             | T    | P                  | L                | T   | P     | Total |
| 25VSE11ME02 | Creative Coding in Python | --                            | --   | 4                  | --               | --  | 2     | 2     |
|             |                           |                               |      | Examination Scheme |                  |     |       |       |
|             |                           |                               | ISE1 | MSE                | ISE2             | ESE | Total |       |
|             |                           | Lab                           | 50   | --                 | 50               | --  | 100   |       |

| Pre-requisite Course Codes |     |   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | Demonstrate awareness of skills of 21 <sup>st</sup> century engineer                |
|                            | CO2 | Demonstrate basic concepts of python programming.                                   |
|                            | CO3 | Identify, install and utilize python packages.                                      |
|                            | CO4 | Illustration of data analytics and data visualization using Python libraries        |
|                            | CO5 | Create GUI Applications using Python.   |
|                            | CO6 | Demonstrate creativity while implementing solution for a given problem using python |

| Module No. | Unit No. | Topics  |
|------------|----------|---|
| 1          |          | <b>21<sup>st</sup> century skills</b>   |
|            |          | Introduction and Importance of 21 <sup>st</sup> Century skills, case studies of creativity in engineering, Creator Tool PictoBloX, Github |
| 2          |          | <b>Python Fundamentals:</b>   |
|            | 2.1      | <b>Basic Data Types:</b> Letter Counter App, Right Triangle Solver App, Multiplication Exponent Table Program                             |
|            | 2.2      | <b>Lists:</b> Grade Sorter App, Grocery List App, Basketball Roster Program   |
|            | 2.3      | <b>Dictionaries:</b> Thesaurus App, Code Breakers App   |
| 3          |          | <b>Decision Flow Control Statements</b>   |
|            | 3.1      | <b>For Loops:</b> Binary Hexadecimal Conversion App, Grade Point Average Calculator App   |
|            | 3.2      | <b>Conditionals:</b> Voter Registration App, Rock, Paper, Scissors App  |
|            | 3.3      | <b>While Loops:</b> Guess the Word App, PowerBall Simulation App  |
| 4          |          | <b>Functions</b>  |
|            | 4.1      | <b>Functions:</b> Head to Head Tic-Tac-Toe App, Bank Deposit and Withdrawal Program   |
|            | 4.2      | <b>Classes:</b> Casino Blackjack App  |
| 5          |          | <b>Graphics and GUI</b>   |
|            | 5.1      | <b>Turtle</b> - Hirst Painting  |
|            | 5.2      | <b>Tkinter</b> - Building a Password Manager GUI App.   |
| 6          |          | <b>Python in Data Sciences for Beginner</b>   |
|            | 6.1      | <b>NumPy, Pandas, Matplotlib:</b> Data Analysis and visualization of any data set (Stock market/healthcare/weather/Agriculture)           |
| 7          |          | <b>Project Development using Python for various engineering domains like electronics, mechanical etc.</b>                                 |



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**Course Assessment:**

**Lab:**

**ISE:**

**1. ISE-1**

Experiments: 20 Marks  
Quiz: 10 Marks  
Design contest: 20 Marks

**2. ISE-2**

Experiments: 20 Marks  
Quiz: 10 Marks  
Mini Project: 20 Marks

**Recommended Books:**

- [1] Yashvant Kanetkar, "Let us Python: Python is Future, Embrace it fast", BPB Publications; 1<sup>st</sup> edition (8 July 2019).
- [2] Dusty Phillips, "Python 3 object-oriented Programming", Second Edition  
PACKT Publisher, August 2015.
- [3] John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).
- [4] Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
- [5] Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication
- [6] Introduction to computing and problem solving using python, E Balagurusamy,  
McGraw Hill Education

**Online Resources:**

- 1. Python 3 Documentation: <https://docs.python.org/3/>
- 3. "The Python Tutorial", <http://docs.python.org/release/3.0.1/tutorial/>
- 4. <http://spoken-tutorial.org>
- 5. Python 3 Tkinter library Documentation: <https://docs.python.org/3/library/tk.html>
- 6. Numpy Documentation: <https://numpy.org/doc/>
- 7. Pandas Documentation: <https://pandas.pydata.org/docs/>
- 8. Matplotlib Documentation: <https://matplotlib.org/3.2.1/contents.html>
- 9. Scipy Documentation : <https://www.scipy.org/docs.html>
- 10. Machine Learning Algorithm Documentation: <https://scikit-learn.org/stable/>
- 11. <https://nptel.ac.in/courses/106/106/106106182/>
- 12. NPTEL course: "The Joy of Computing using Python"



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| Course Code | Course Name                             | Teaching Scheme<br>(Hrs/week) |             |            | Credits Assigned |            |              |       |  |  |
|-------------|---|-------------------------------|-------------|------------|------------------|------------|--------------|-------|--|--|
|             |   | L                             | T           | P          | L                | T          | P            | Total |  |  |
| 25VSE11ME01 | Measuring Instruments and Testing Tools | --                            | --          | 2          | --               | --         | 2            | 2     |  |  |
|             |   | <b>Examination Scheme</b>     |             |            |                  |            |              |       |  |  |
|             |   |                               | <b>ISE1</b> | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |  |  |
|             |   | Theory                        | --          | --         | --               | --         |              |       |  |  |
|             |   | Lab                           | <b>50</b>   | --         | <b>50</b>        | --         | <b>100</b>   |       |  |  |
|             |   |                               |             |            |                  |            |              |       |  |  |

| Pre-requisite Course Codes |     |  |
|----------------------------|-----|--|
| Course Outcomes            | CO1 | Have a working knowledge about the measurement process, units of measurements, static and dynamic characteristics of instrument. |
|                            | CO2 | Identify and classify types of test & measuring instruments that are available in the laboratory                                 |
|                            | CO3 | Find out and verify the manufacturers, make, models, market cost and specifications of the given instrument                      |
|                            | CO4 | Select a suitable test & measuring instrument for any given system, application or a process                                     |
|                            | CO5 | Understand the importance & significance of calibration of measuring instrument  |
|                            | CO6 | Study various quality standards for Measurement, Inspection and Testing  |

#### Teaching Learning Methodology: Role Play Model

**a. Instructor**

Responsibilities : Explain theoretical background, provide required sample formats, guide students in identification of appropriate online material, supervision and assessment of overall activity, summarize the activity

**b. First Group of Students :Customer**

Responsibilities : To finalize specifications of instrument to be purchased prepare request for quotations, prepare comparative statement, preparation for purchase order (PO)

**c. Second Group of Students: Manufacturer / Vendor**

Responsibilities : To maintain the specifications of manufactured instruments, to submit quotations including all applicable taxes, to prepare invoice as per purchase order (PO)

**d. Third Group of Students: Sales/Service Engineer**

Responsibilities : To demonstrate capabilities of various instruments and convince customer to purchase a particular instrument, to prepare Delivery Challan, Install the instrument and prepare Installation report, Demonstrate all the functions and uses of the instrument



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| Module No.   | Unit No. | Topics   | Ref.           | Hrs.      |
|--------------|----------|--|----------------|-----------|
| 1            |          | <b>Introduction to Basic Concepts of Measurements</b>  | 1,2,3,<br>8, 9 |           |
|              | 1.1      | Introduction to the measurement process & its aim, functional elements of an instrumentation system, Need of Inspection, Go-NoGo Gauges. Difference between measuring instrument and Comparator.       |                | 4         |
|              | 1.2      | Introduction to Standards such as IS/ BIS, NABL standards. Errors in measurement, types, classification, Calibration & its importance, Calibration method.   |                | 4         |
| 2            | 1.3      | Difference between sensor and transducer, classification of Types of electrical, electronic and mechanical sensors   |                | 4         |
|              |          | <b>Units, Standards &amp; Characteristics</b>  | 1,2,3,<br>8,9  |           |
|              | 2.1      | Unit systems – MKS, CGS & SI for electrical & mechanical quantities  |                | 4         |
| 3            | 2.2      | Performance characteristics of instruments – static characteristics & dynamic characteristics, List of Manufacturers/ vendors dealing with sale, service and repair of measuring and test instruments. |                | 4         |
|              |          | <b>Mechanical Test &amp; Measuring Instruments</b>   | 1,2,3,<br>8,9  |           |
|              | 3.1      | Measurement of linear dimensions using Vernier caliper.  |                | 2         |
|              | 3.2      | Measurement of gauge thickness using Screw Thread micrometer .   |                | 2         |
|              | 3.3      | Measurement & Marking dimensions using Vernier height gauge  |                | 2         |
|              | 3.4      | Measurement of small dimensions by Optical Profile Projector<br>Setting of dimensions using precision gauge blocks ( slip gauges) by   |                | 2         |
|              | 3.5      | Wringing process.<br>Identification of surface flatness defects using principle of interferometry by optical flats and monochromatic light.  |                | 2         |
|              | 3.6      | Measurement of components deviations w.r.t. standard using mechanical comparator   |                | 2         |
|              | 3.7      | Spirit Level for Alignment test  |                | 2         |
|              | 3.8      | Feeler Gauges for Gap measurement  |                | 2         |
| 4            | 3.9      | Thread Gauges for thread measurement   |                | 2         |
|              |          | <b>Electronic Test &amp; Measuring Instruments</b>   | 4,6,7          |           |
|              | 4.1      | Digital Multimeter   |                | 2         |
|              | 4.2      | DC Power Supply  |                | 2         |
|              | 4.3      | Function Generator   |                | 2         |
| 5            | 4.4      | Digital Storage Oscilloscope (DSO)   |                | 2         |
|              |          | <b>Sensors &amp; Transducers</b>   | 3,5            |           |
|              | 5.1      | Proximity Sensors – Capacitive, Inductance, Optical sensors<br>Mechanical Limit Switch.  |                | 2         |
|              | 5.2      | Piezo-Transducers for Pressure measurement,  |                | 4         |
|              | 5.3      | Strain Gauge Load cell   |                |           |
|              | 5.4      | Linear Variable Differential Transducer (LVDT)   |                |           |
| <b>Total</b> |          |  |                | <b>52</b> |



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**Course Assessment:**

**Laboratory work: (ISE)**

|  |                         |
|--|-------------------------|
| <b>1. ISE-1</b>  | <b>Total Marks : 50</b> |
| A) After completion of Module 1 and Module 2, <b>Online Quiz / Q/A Assignment of 30 marks</b> to be conducted to check theoretical knowledge of measuring instruments and testing tools. |                         |
| B) To conduct Minimum 4 experiment from the module 3 (Total marks = $4 \times 5 = 20$ marks)   |                         |
| <b>2. ISE-2</b>  | <b>Total Marks : 50</b> |
| A) To perform role play (Group Activity of 4 students each) ( <b>Total marks = 20 marks</b> )  |                         |
| B) To conduct Minimum 6 experiment from the module 3, 4, 5 (Total marks = $6 \times 5 = 30$ marks)   |                         |

**Recommended Books:**

**Text Books:**

- [1] Engineering. Metrology, I.C. GUPTA, Dhanpat Rai Publications.
- [2] Engineering. Metrology, R. K. Jain, Khanna Publisher.
- [3] Engineering Metrology and Measurements, Raghavendra, Krishnamurthy, OUP India, 2013
- [4] Fundamentals of Micro-electronics, Behzad Razavi, Wiley Publications, 2008
- [5] Sensors and Transducers, Second Edition, D.Patranabis, PHI publications, 2003

**Reference Books:**

- [6] J. Millman and A. Grabel, "Microelectronics", Tata McGraw Hill, 2<sup>nd</sup> Edition.
- [7] Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Edition.
- [8] Engineering Metrology, K. J. Hume, Kalyani publication
- [9] Engineering. Metrology, Hume K.G., M C Donald, Technical & Scientific, London.



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| Course Code | Course Name                       | Teaching Scheme<br>(Hrs/week) |             |            | Credits Assigned |            |              |       |
|-------------|-----------------------------------|-------------------------------|-------------|------------|------------------|------------|--------------|-------|
|             |                                   | L                             | T           | P          | L                | T          | P            | Total |
| 25AEC11ME01 | <b>Art of Communication (AoC)</b> | 1                             | --          | 2          | 1                | --         | 1            | 2     |
|             |                                   | <b>Examination Scheme</b>     |             |            |                  |            |              |       |
|             |                                   |                               | <b>ISE1</b> | <b>MSE</b> | <b>ISE2</b>      | <b>ESE</b> | <b>Total</b> |       |
|             |                                   | Lab                           | 40          | --         | 60               | --         | 100          |       |
|             |                                   |                               |             |            |                  |            |              |       |

| Pre-requisite Course Codes |     | Basic Language Skills   |
|----------------------------|-----|---|
| Course Outcomes            | CO1 | Understand the roots and fundamentals of communication.                         |
|                            | CO2 | Apply Strategies to develop vocabulary and grammar skills for competitive exams |
|                            | CO3 | Develop Listening, Reading, Speaking and Writing skills                         |
|                            | CO4 | Acquire effective correspondence skills   |
|                            | CO5 | Relate Communication to Management Information Systems in the corporate sector  |

| Module No. | Unit No. | Topics  | Ref. | Hrs. |
|------------|----------|---|------|------|
| 1          |          | <b>Introduction to Communication</b>  |      |      |
|            | 1.1      | <b>Ancient India and Communication:</b> Roots of Communication skills in Indian Tradition, Importance of Communication, Cycle.  |      | 4    |
|            | 1.2      | <b>Strengths and Weaknesses of Oral and Non-verbal Communication</b><br>(Kinesics, Proxemics, Chronemics, Haptics, Oculistics, Olfactics, Paralanguage)<br><b>Steps to Public Speaking:</b> Planning your speech, Delivery of Speech, Dealing with stage fear |      |      |
|            | 1.3      | <b>Barriers and Gateways in Communication:</b><br>Types of barriers: Physical, Mechanical, Psychological, Semantic and Cross-cultural   |      |      |
| 2          | 2.1      | <b>Verbal Ability in Competitive exams:</b><br>English grammar and Strategies for UPSC/GATE/GRE/IELTS/TOEFL/CAT   |      | 2    |
| 3          | 3.1      | <b>Communicative Competence</b><br><b>Listening:</b> Motivational Talks or TED TALKS  |      | 4    |
|            | 3.2      | <b>Reading :</b> Self-learning (Reading of Literary piece or Research paper (Environment, Sustainability and Social aspects))   |      |      |
|            | 3.3      | <b>Speaking:</b> Discussion on Ethics and on self-learning tasks  |      |      |
|            | 3.4      | <b>Writing:</b> Review writing or writeup for public speaking   |      |      |
| 4          | 4.1      | <b>Effective Correspondence</b>   |      | 2    |



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|   |     |   |              |           |
|---|-----|---|--------------|-----------|
|   | 4.2 | <b>Introduction, Do's and Don'ts, Format and Types</b>  |              |           |
|   |     | <ul style="list-style-type: none"> <li>Application for internship</li> <li>Request/Permission</li> </ul>        |              |           |
| 5 |     | <b>Management Information System</b>  |              | 1         |
|   | 5.1 | <ul style="list-style-type: none"> <li>Introduction, Purpose, Structure, Characteristics, Limitation</li> </ul> |              |           |
|   |     |   |              |           |
|   |     |   | <b>Total</b> | <b>13</b> |

| <b>Sr. No.</b> | <b>Title of the assignments/Activities to be carried out in the Lab</b>                             | <b>Marks</b> |
|----------------|---|--------------|
| 1              | Draft and Orally presenting Public speaking/ Extempore  | <b>10</b>    |
| 2              | Presentation/Poster Making - Modern times learning from Vedas/Upanishads/ Bhagvad gita/ Mahabharata | <b>20</b>    |
| 3              | Aptitude Test on verbal ability   | <b>10</b>    |
| 4              | Listening skills: Quiz/ Subjective type questions   | 10           |
| 5              | Reading& Writing skills: Reviewing a book/ Research paper   | 10           |
| 6              | Speaking skills: Panel Discussion   | 10           |
| 7              | Correspondence  | 10           |
| 8              | Management Information system assignment  | 10           |
| 9              | Communication module assignment   | 10           |
|                | <b>Total</b>  | <b>100</b>   |

**ISE1: 3 Activities**

Public Speaking, Extempore, Aptitude test, presenting through Power point or Poster Making  
Marks: 40

Learning outcome: Acquiring public Speaking skills for formal events and improving verbal ability

PO10: Communication, PO9: Individual and Team Work, P12: Long Life Learning

**ISE: 2 Activities, 4 assignments**

Marks: 60 Marks

Learning outcome: Efficiently developing listening, reading and writing skills

P10: Communication, PO8: Ethics, PO9: Individual and Team Work, P12: Long Life Learning

**Reference Books:**

| <b>Sr. No.</b> | <b>Title</b>              | <b>Edition</b> | <b>Authors</b>                    | <b>Publisher</b>                  | <b>Year</b> |
|----------------|---------------------------|----------------|-----------------------------------|-----------------------------------|-------------|
| 1              | Communication Skills      | 2013           | Shirley Mathews                   | Technical Publication, Pune       | 2022        |
| 2              | English Vocabulary in Use | 1999           | Michael McCarthy, Felicity O'Dell | Cambridge University Press, India | 1999        |
| 3              | Oxford Practice Grammar   | 1999           | John Eastwood                     | Oxford, India                     | 1999        |
| 4              | Communication Skills      | 2011           | Meenakshi Raman, Sangeeta Sharma  | Oxford, India                     | 2011        |



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|   |                           |      |                |                        |      |
|---|---------------------------|------|----------------|------------------------|------|
| 5 | English Grammar for Today | 2005 | Geoffrey Leech | Palgrave, UK           | 2005 |
| 6 | Word Power Made Easy      | 1978 | Norman Lewis   | Anchor Books, New York | 1978 |