**DEPARTMENT OF FORESTRY**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS21101 | Information and Communication Technology | 2 | 0 | 2 | 3 |
| 2. | CY21101 | Plant Biochemistry | 1 | 0 | 2 | 2 |
| 3. | HS21101 | Communication Skills and Personality Development | 2 | 0 | 2 | 3 |
| 4. | MA21102 | Basic Mathematics | 2 | 0 | 0 | 2 |
| 5. | FR21101 | Introduction to Forestry | 2 | 0 | 0 | 2 |
| 6. | FR21102 | Dendrology | 2 | 0 | 2 | 3 |
| 7. | FR21103 | Introduction to Agronomy and Horticulture | 2 | 0 | 2 | 3 |
| 8. | FR21104 | Wood Anatomy | 2 | 0 | 2 | 3 |
| 9. | NP21161 | NCC – I / NSS – I | 0 | 0 | 2 | 0 |
| 10. | NP21162 | Physical Education – I | 0 | 0 | 2 | 0 |
| **Total** | | | | | | **21** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA21202 | Statistical Methods and Experimental Designs | 2 | 0 | 2 | 3 |
| 2. | FR21201 | Plant Physiology | 2 | 0 | 2 | 3 |
| 3. | FR21202 | Theory and Practice of Silviculture | 2 | 0 | 2 | 3 |
| 4. | FR21203 | Geology and Soils | 2 | 0 | 2 | 3 |
| 5. | FR21204 | Wildlife Biology | 2 | 0 | 2 | 3 |
| 6. | FR21205 | Forest Protection | 2 | 0 | 2 | 3 |
| 7. | FR21206 | Plant Cytology and Genetics | 1 | 0 | 2 | 2 |
| 8. | NP21261 | NCC – II / NSS – II | 0 | 0 | 2 | 0 |
| 9. | NP21262 | Physical Education – II | 0 | 0 | 2 | 0 |
| **Total** | | | | | | **20** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE22121 | Forest Survey and Engineering | 2 | 0 | 2 | 3 |
| 2. | FR22101 | Environmental Studies and Disaster Management | 2 | 0 | 2 | 3 |
| 3. | FR22102 | Ornithology and Herpatology | 2 | 0 | 2 | 3 |
| 4. | FR22103 | Ethnobotany, Medicinal and Aromatic plants | 2 | 0 | 2 | 3 |
| 5. | FR22104 | Tree Improvement | 2 | 0 | 2 | 3 |
| 6. | FR22105 | Principles of Agroforestry | 2 | 0 | 2 | 3 |
| 7. | FR22106 | Forest Mensuration | 2 | 0 | 2 | 3 |
| 8. | NP22161 | NCC – III / NSS – III | 0 | 0 | 2 | 0 |
| 9. | NP22162 | Physical Education – III | 0 | 0 | 2 | 0 |
| **Total** | | | | | | **21** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | FR22201 | Forest Management | 2 | 0 | 2 | 3 |
| 2. | FR22202 | Silviculture of Indian Trees | 2 | 0 | 2 | 3 |
| 3. | FR22203 | Wood Products and Utilization | 2 | 0 | 2 | 3 |
| 4. | FR22204 | Forest Ecology and Biodiversity | 2 | 0 | 2 | 3 |
| 5. | FR22205 | Soil Biology and Fertility | 2 | 0 | 2 | 3 |

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| 6. | FR22206 | Seed Technology and Nursery Management | 2 | 0 | 2 | 3 |
| 7. | FR22207 | Forest Tribology and Anthropology | 2 | 0 | 0 | 2 |
| 8. | FR22208 | Rangeland and Livestock Management | 1 | 0 | 2 | 2 |
| 9. | FR22266 | Study Tour of State Forest | 0 | 0 | 0 | 0 |
| **Total** | | | | | | **22** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE23121 | Forest Hydrology and Watershed Management | 2 | 0 | 2 | 3 |
| 2. | HS23102 | Entreprenuership Development and Business Management | 2 | 0 | 0 | 2 |
| 3. | FR23101 | Climate Science | 2 | 0 | 2 | 3 |
| 4. | FR23102 | Plantation Forestry | 2 | 0 | 2 | 3 |
| 5. | FR23103 | Forest Extension and Community Forestry | 2 | 0 | 2 | 3 |
| 6. | FR23104 | Logging and Ergonomics | 1 | 0 | 2 | 2 |
| 7. | FR23151 | Geomatics | 1 | 0 | 4 | 3 |
| 8. | FR23152 | Experiential Learning | 0 | 0 | 10 | 5 |
| **Total** | | | | | | **24** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23202 | Forest Economics and Marketing | 3 | 0 | 0 | 3 |
| 2. | HS23203 | Marketing of Non-Timber Forest Products | 2 | 0 | 2 | 3 |
| 3. | FR23201 | Wood Science and Technology | 2 | 0 | 2 | 3 |
| 4. | FR23202 | Forest Laws, Legislation and Policies | 2 | 0 | 0 | 2 |
| 5. | FR23203 | Certification of Forest Products | 2 | 0 | 0 | 2 |
| 6. | FR23204 | Recreation and Urban Forestry | 1 | 0 | 2 | 2 |
| 7. | FR23205 | Wildlife Management | 1 | 0 | 2 | 2 |
| 8. | FR23251 | Experiential Learning | 0 | 0 | 10 | 5 |
| 9. | FR23266 | All India Study Tour | 0 | 0 | 0 | 0 |
| **Total** | | | | | | **22** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | FR 24179 | Forestry Work Experience**\*** | 0 | 0 | 40 | 20 |
| **Total** | | | | | | **20** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | FR24201 | Agricultural Informatics | 2 | 0 | 2 | 3 |
| 2. | FR24202 | Forest Biotechnology | 2 | 0 | 2 | 3 |
| 3. | FR24203 | Agroforestry Systems and Management | 2 | 0 | 2 | 3 |
| 4. | FR24204 | Forest Inventory and Yield Prediction | 1 | 0 | 2 | 2 |
| 5. | FR24205 | Restoration Ecology | 1 | 0 | 2 | 2 |
| 6. | FR24299 | Project Work and Dissertation | 0 | 0 | 20 | 10 |
| 7. | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 02 |
| **Total** | | | | | | **25** |

\*Students shall be attached with the forest and allied departments/ villages heads etc. for field work and experience for the periods mentioned in content.

**DEPARTMENT OF AGRICULTURAL ENGINEERING**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21101 | Engineering Physics | 4 | 0 | 2 | 05 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 04 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 05 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 03 |
| 5. | AE21101 | Soil Science and Crop Production | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **20** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CY21202 | Engineering Chemistry – B | 3 | 1 | 2 | 05 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 04 |
| 3. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 04 |
| 4. | ES21251 | Workshop Practice | 0 | 0 | 6 | 03 |
| 5. | HS21201 | Communication Skills | 2 | 0 | 2 | 03 |
| 6. | AE21201 | Engineering Thermodynamics | 2 | 1 | 0 | 03 |
| 7. | ES21277 | Environmental Science (Audit) | 2 | 0 | 0 | 00 |
| **Total** | | | | | | **22** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 04 |
| 2. | ES22100 | Engineering Mechanics | 3 | 1 | 0 | 04 |
| 3. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 04 |
| 4. | AE22101 | Agricultural Surveying | 2 | 0 | 2 | 03 |
| 5. | AE22102 | Soil Mechanics | 2 | 0 | 2 | 03 |
| 6. | AE22103 | Agricultural Process Engineering | 2 | 0 | 2 | 03 |
| **Total** | | | | | | **21** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 03 |
| 2. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 00 |
| 3. | AE22201 | Fluid Mechanics | 2 | 0 | 2 | 03 |
| 4. | AE22202 | Strength of Materials | 2 | 1 | 0 | 03 |
| 5. | AE22203 | IC Engines | 2 | 1 | 0 | 03 |
| 6. | AE22204 | Soil and Water Conservation Engineering | 2 | 0 | 2 | 03 |
| 7. | AE22205 | Transfer Processes in Food Engineering | 2 | 1 | 0 | 03 |
| 8. | AE22206 | Renewable Sources of Energy | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **21** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23101 | Principles of Economics | 3 | 0 | 0 | 03 |
| 2. | HS23177 | Essence of Indian Knowledge and Tradition (Audit) | 2 | 0 | 0 | 00 |
| 3. | AE23101 | Irrigation Engineering | 2 | 0 | 2 | 03 |
| 4. | AE23102 | Drainage Engineering | 2 | 0 | 2 | 03 |
| 5. | AE23103 | Farm Tractors | 2 | 0 | 2 | 03 |
| 6. | AE23104 | Machine Theory and Design | 2 | 1 | 0 | 03 |
| 7. | AE23105 | Unit Operations in Dairy and Food Engineering | 2 | 1 | 0 | 03 |
| 8. | AE23166 | Study Tour (Audit) | 0 | 0 | 0 | 00 |
| **Total** | | | | | | **18** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behaviour | 3 | 0 | 0 | 03 |
| 2. | MO230\*\* | Open Elective – I (From MOOC) | 3 | 0 | 0 | 03 |
| 3. | AE23201 | Hydrology and Watershed Management | 2 | 1 | 0 | 03 |
| 4. | AE23202 | Farm Machinery – I | 2 | 0 | 2 | 03 |
| 5. | AE23203 | Food Process Technology | 2 | 0 | 2 | 03 |
| 6. | AE230\*\* | Programme Elective – I | \* | \* | \* | 03 |
| 7. | AE230\*\* | Programme Elective – II | \* | \* | \* | 03 |
| 8. | AE23289 | Seminar | 0 | 0 | 2 | 01 |
| **Total** | | | | | | **22** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | \*\*240\*\* | Open Elective – II | \* | \* | \* | 03 |
| 2. | AE24101 | Tractor Systems and Performance | 2 | 0 | 2 | 03 |
| 3. | AE24102 | Groundwater and Pump Engineering | 2 | 1 | 0 | 03 |
| 4. | AE24103 | Farm Produce and Storage Engineering | 2 | 0 | 2 | 03 |
| 5. | AE240\*\* | Programme Elective – III | \* | \* | \* | 03 |
| 6. | AE240\*\* | Programme Elective – IV | \* | \* | \* | 03 |
| 7. | AE24199 | Project – I | 0 | 0 | 6 | 03 |
| 8. | AE24179 | Industrial Training (Audit) | 0 | 0 | 0 | 00 |
| **Total** | | | | | | **21** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MO240\*\* | Open Elective – III (From MOOC) | 3 | 0 | 0 | 03 |
| 2. | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 03 |
| 3. | AE24201 | Farm Machinery – II | 2 | 0 | 0 | 02 |
| 4. | AE240\*\* | Programme Elective – V | \* | \* | \* | 03 |
| 5. | AE240\*\* | Programme Elective – VI | \* | \* | \* | 03 |
| 6. | AE24299 | Project – II | 0 | 0 | 12 | 06 |
| 7. | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 02 |
| **Total** | | | | | | **22** |

**List of Electives**

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| **Programme Electives – I & II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE23001 | Agricultural Instrumentation | 2 | 0 | 2 | 03 |
| 2. | AE23002 | Building Construction and Cost Estimation | 2 | 1 | 0 | 03 |
| 3. | AE23003 | Command Area Development | 2 | 1 | 0 | 03 |
| 4. | AE23004 | Food Plant Utilities and Sanitation | 2 | 1 | 0 | 03 |
| 5. | AE23005 | Mechanics of Tillage and Traction | 2 | 1 | 0 | 03 |
| 6. | AE23006 | Precision Farming | 2 | 0 | 2 | 03 |
| 7. | AE23007 | Processing of Milk and Milk Products | 2 | 0 | 2 | 03 |
| 8. | AE23008 | Testing of Tractors and Farm Equipment | 2 | 0 | 2 | 03 |
| 9. | AE23009 | Wasteland Development | 2 | 1 | 0 | 03 |

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| **Programme Electives – III & IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE24001 | Ergonomics | 2 | 0 | 2 | 03 |
| 2. | AE24002 | Floods and Droughts | 2 | 1 | 0 | 03 |
| 3. | AE24003 | Food Processing Equipment Design | 2 | 1 | 0 | 03 |
| 4. | AE24004 | Food Quality and Control | 2 | 0 | 2 | 03 |
| 5. | AE24005 | Hydraulic Drives and Controls | 2 | 1 | 0 | 03 |
| 6. | AE24006 | Modelling and Simulation for Agricultural Applications | 2 | 1 | 0 | 03 |
| 7. | AE24007 | On-Farm Water Management | 2 | 1 | 0 | 03 |
| 8. | AE24008 | Refrigeration and Air-Conditioning | 2 | 1 | 0 | 03 |
| 9. | AE24009 | Remote Sensing and GIS for Land and Water Management | 2 | 1 | 0 | 03 |

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| **Programme Electives – V & VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE24021 | Agricultural Meteorology and Climate Change | 3 | 0 | 0 | 03 |
| 2. | AE24022 | Agricultural Safety | 3 | 0 | 0 | 03 |
| 3. | AE24023 | Computer Application in Agriculture | 1 | 0 | 4 | 03 |
| 4. | AE24024 | Design of Soil Conservation Structures | 2 | 1 | 0 | 03 |
| 5. | AE24025 | Development of Processed Products | 2 | 0 | 2 | 03 |
| 6. | AE24026 | Food Packaging Technology | 2 | 0 | 2 | 03 |
| 7. | AE24027 | Introduction to Computer Aided Design | 1 | 0 | 4 | 03 |
| 8. | AE24028 | Pressurized Irrigation Systems | 2 | 0 | 2 | 03 |
| 9. | AE24029 | Tractor System Design | 2 | 1 | 0 | 03 |

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE24041 | Geo-Informatics | 2 | 1 | 0 | 03 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | AE24042 | Computer Aided Design | 1 | 0 | 4 | 03 |

**DEPARTMENT OF CIVIL ENGINEERING**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21102 | Introduction to Mechanics | 4 | 0 | 2 | 5 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 4 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 5 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 3 |
| 5. | FR21121 | Biology for Engineers | 2 | 1 | 0 | 3 |
| **Total** | | | | | | **20** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CY21202 | Engineering Chemistry – B | 3 | 1 | 2 | 5 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 4 |
| 3. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 4 |
| 4. | ES21251 | Workshop Practice | 0 | 0 | 6 | 3 |
| 5. | HS21201 | Communication Skills | 2 | 0 | 2 | 3 |
| 6. | CE21201 | Engineering Mechanics | 2 | 1 | 0 | 3 |
| **Total** | | | | | | **22** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 4 |
| 2. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 4 |
| 3. | CE22101 | Mechanics of Solid | 2 | 1 | 0 | 3 |
| 4. | CE22102 | Introduction to Fluid Mechanics | 2 | 0 | 2 | 3 |
| 5. | CE22103 | Surveying and Geomatics | 2 | 0 | 2 | 3 |
| 6. | CE22104 | Geotechnical Engineering – I | 2 | 0 | 2 | 3 |
| 7. | CE22105 | Transportation Engineering – I | 2 | 0 | 2 | 3 |
| 8. | CE22106 | Environmental Engineering – I | 2 | 0 | 2 | 3 |
| **Total** | | | | | | **26** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 3 |
| 2. | ME22221 | Basics of Mechanical Engineering | 2 | 0 | 0 | 2 |
| 3. | CE22201 | Instrumentation and Sensor Technologies for Civil Engineering Applications | 1 | 1 | 2 | 3 |
| 4. | CE22202 | Energy Science and Engineering | 2 | 0 | 0 | 2 |
| 5. | CE22203 | Structural Analysis and Design of Steel Structures | 4 | 0 | 0 | 4 |
| 6. | CE22204 | Design of RCC Structures | 2 | 1 | 0 | 3 |
| 7. | CE22205 | Hydrology and Water Resources Engineering | 2 | 1 | 0 | 3 |
| 8. | CE22251 | Computer-aided Civil Engineering Drawing | 0 | 0 | 4 | 2 |
| 9. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 0 |
| **Total** | | | | | | **22** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23101 | Principles of Economics | 3 | 0 | 0 | 3 |
| 2. | HS23177 | Essence of Indian Knowledge and Tradition (Audit) | 2 | 0 | 0 | 0 |
| 3. | CE23101 | Structural Analysis | 2 | 1 | 0 | 3 |
| 4. | CE23102 | Geotechnical Engineering – II | 2 | 0 | 2 | 3 |
| 5. | CE23103 | Environmental Engineering – II | 2 | 0 | 2 | 3 |
| 6. | CE23104 | Transportation Engineering – II | 2 | 0 | 2 | 3 |
| 7. | CE23105 | Materials Testing and Evaluation | 1 | 1 | 2 | 3 |
| 8. | CE23106 | Disaster Preparedness and Planning | 1 | 1 | 0 | 2 |
| 9. | CE23166 | Study Tour (Audit) | 0 | 0 | 0 | 0 |
| **Total** | | | | | | **20** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behaviour | 3 | 0 | 0 | 3 |
| 2. | MO230\*\* | Open Elective – I (From MOOC) | 3 | 0 | 0 | 3 |
| 3. | CE23201 | Construction Engineering & Management | 2 | 0 | 0 | 2 |
| 4. | CE230\*\* | Programme Elective – I | 3 | 0 | 0 | 3 |
| 5. | CE230\*\* | Programme Elective – II | 3 | 0 | 0 | 3 |
| 6. | CE230\*\* | Programme Elective – III | 3 | 0 | 0 | 3 |
| 7. | CE230\*\* | Programme Elective – IV | 3 | 0 | 0 | 3 |
| 8. | CE23289 | Seminar | 0 | 0 | 2 | 1 |
| **Total** | | | | | | **21** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | \*\*24\*\*\* | Open Elective – II | \* | \* | \* | 3 |
| 2. | CE24101 | Engineering Economics and Estimation | 2 | 1 | 0 | 3 |
| 3. | CE24102 | Engineering Geology | 2 | 0 | 2 | 3 |
| 4. | CE240\*\* | Programme Elective – V | 3 | 0 | 0 | 3 |
| 5. | CE240\*\* | Programme Elective – VI | 3 | 0 | 0 | 3 |
| 6. | CE24199 | Project – I | 0 | 0 | 6 | 3 |
| 7. | CE24179 | Industrial Training | 0 | 0 | 0 | 3 |
| **Total** | | | | | | **21** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MO240\*\* | Open Elective – III (From MOOC) | 3 | 0 | 0 | 3 |
| 2. | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 3 |
| 3. | CE240\*\* | Programme Elective – VII | 3 | 0 | 0 | 3 |
| 4. | CE240\*\* | Programme Elective – VIII | 3 | 0 | 0 | 3 |
| 5. | CE24299 | Project – II | 0 | 0 | 12 | 6 |
| 6. | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 2 |
| **Total** | | | | | | **20** |

**List of Electives**

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| **Programme Elective – I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE23001 | Pavement Materials | 3 | 0 | 0 | 3 |
| 2. | CE23002 | Pavement Design | 3 | 0 | 0 | 3 |
| 3. | CE23003 | Public Transportation Systems Planning | 3 | 0 | 0 | 3 |
| 4. | CE23004 | Traffic Engineering and Management | 3 | 0 | 0 | 3 |
| 5. | CE23005 | Urban Transportation Planning | 3 | 0 | 0 | 3 |
| 6. | CE23006 | Geometric Design of Highways and Transportation facilities | 3 | 0 | 0 | 3 |
| 7. | CE23007 | Intelligent Transportation Systems | 3 | 0 | 0 | 3 |

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| **Programme Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE23011 | Construction Productivity | 3 | 0 | 0 | 3 |
| 2. | CE23012 | Building Construction Practice | 3 | 0 | 0 | 3 |
| 3. | CE23013 | Construction Project Planning and System | 3 | 0 | 0 | 3 |
| 4. | CE23014 | Advanced Concrete Technology for Construction | 3 | 0 | 0 | 3 |
| 5. | CE23015 | Contracts Management | 3 | 0 | 0 | 3 |
| 6. | CE23016 | Construction Equipment and Automation | 3 | 0 | 0 | 3 |
| 7. | CE23017 | Repairs and Rehabilitation of Structures | 3 | 0 | 0 | 3 |

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| **Programme Elective – III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE23021 | Mathematical Modeling in Environmental Engineering | 3 | 0 | 0 | 3 |
| 2. | CE23022 | Advanced Wastewater Treatment Techniques | 3 | 0 | 0 | 3 |
| 3. | CE23023 | Solid Waste Management | 3 | 0 | 0 | 3 |
| 4. | CE23024 | Industrial Pollution and Control | 3 | 0 | 0 | 3 |
| 5. | CE23025 | Environmental Impact Assessment | 3 | 0 | 0 | 3 |
| 6. | CE 23026 | Solid and Hazardous Waste Management | 3 | 0 | 0 | 3 |
| 7. | CE 23027 | Air Pollution Engineering | 3 | 0 | 0 | 3 |

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| **Programme Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE23031 | River Engineering | 3 | 0 | 0 | 3 |
| 2. | CE23032 | Transient Flow Analysis | 3 | 0 | 0 | 3 |
| 3. | CE23033 | Computational Methods in Hydraulics and Environmental Engineering Applications | 3 | 0 | 0 | 3 |
| 4. | CE23034 | Open Channel Hydraulics | 3 | 0 | 0 | 3 |
| 5. | CE23035 | Hydro-Power Development | 3 | 0 | 0 | 3 |
| 6. | CE23036 | Hydraulic Engineering | 3 | 0 | 0 | 3 |

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| **Programme Elective – V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE24001 | Water Quality Engineering | 3 | 0 | 0 | 3 |
| 2. | CE24002 | Surface Hydrology | 3 | 0 | 0 | 3 |
| 3. | CE24003 | Environmental Hydrology | 3 | 0 | 0 | 3 |
| 4. | CE24004 | Groundwater Hydrology | 3 | 0 | 0 | 3 |

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| 5. | CE24005 | Flood Control and River Training Works | 3 | 0 | 0 | 3 |
| 6. | CE24006 | Water Resources Systems | 3 | 0 | 0 | 3 |
| 7. | CE24007 | Design of Hydraulic Structures | 3 | 0 | 0 | 3 |

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| **Programme Electives – VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE24011 | Design of Steel Structures | 3 | 0 | 0 | 3 |
| 2. | CE24012 | Matrix Methods of Structural Analysis | 3 | 0 | 0 | 3 |
| 3. | CE24013 | Theory of Elasticity | 3 | 0 | 0 | 3 |
| 4. | CE24014 | Finite Element Methods | 3 | 0 | 0 | 3 |
| 5. | CE24015 | Advanced Mechanics of Solids | 3 | 0 | 0 | 3 |
| 6. | CE24016 | Structural Dynamics | 3 | 0 | 0 | 3 |

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| **Programme Electives – VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE24021 | Advanced Design of RCC Structures | 3 | 0 | 0 | 3 |
| 2. | CE24022 | Bridge Engineering | 3 | 0 | 0 | 3 |
| 3. | CE24023 | Elements of Earthquake Engineering | 3 | 0 | 0 | 3 |
| 4. | CE24024 | Earthquake Resistant Structures | 3 | 0 | 0 | 3 |
| 5. | CE24025 | Design of Offshore and Coastal Structures | 3 | 0 | 0 | 3 |
| 6. | CE24026 | Prefabricated Structures | 3 | 0 | 0 | 3 |

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| **Programme Elective – VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CE24031 | Advanced Soil Mechanics and Foundations | 3 | 0 | 0 | 3 |
| 2. | CE24032 | Machine Foundations | 3 | 0 | 0 | 3 |
| 3. | CE24033 | Earth and Earth Retaining Structures | 3 | 0 | 0 | 3 |
| 4. | CE24034 | Principles and Practices in Geotechnical Engineering | 3 | 0 | 0 | 3 |
| 5. | CE24035 | Ground Improvement Techniques | 3 | 0 | 0 | 3 |
| 6. | CE24036 | Reinforced Earth and Geotextiles | 3 | 0 | 0 | 3 |

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21103 | Quantum Mechanics for Engineers | 4 | 0 | 2 | 05 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 04 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 05 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 03 |
| 5. | FR21121 | Biology for Engineers | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **20** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CY21201 | Engineering Chemistry – A | 3 | 1 | 2 | 05 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 04 |
| 3. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 04 |
| 4. | ES21251 | Workshop Practice | 0 | 0 | 6 | 03 |
| 5. | HS21201 | Communication Skills | 2 | 0 | 2 | 03 |
| 6. | ES21277 | Environmental Science (Audit) | 2 | 0 | 0 | 00 |
| **Total** | | | | | | **19** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 04 |
| 2. | ES22100 | Engineering Mechanics | 3 | 1 | 0 | 04 |
| 3. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 04 |
| 4. | CS22100 | Digital Logic Design | 3 | 0 | 2 | 04 |
| 5. | CS22101 | Data Structure and Algorithms | 3 | 0 | 4 | 05 |
| 6. | CS22102 | Programming Tools and Techniques | 2 | 0 | 4 | 04 |
| **Total** | | | | | | **25** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 03 |
| 2. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 00 |
| 3. | CS22200 | Discrete Mathematics | 3 | 1 | 0 | 04 |
| 4. | CS22201 | Computer Organization and Architecture | 3 | 1 | 2 | 05 |
| 5. | CS22202 | Programming in Java | 2 | 0 | 4 | 04 |
| 6. | CS22203 | Design and Analysis of Algorithms | 3 | 0 | 4 | 05 |
| **Total** | | | | | | **21** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23101 | Principles of Economics | 3 | 0 | 0 | 03 |
| 2. | HS23177 | Essence of Indian Knowledge and Tradition (Audit) | 2 | 0 | 0 | 00 |
| 3. | EC23121 | Signals and Systems | 2 | 1 | 0 | 03 |
| 4. | CS23100 | Database Management Systems | 3 | 1 | 2 | 05 |
| 5. | CS23101 | Formal Language and Automata Theory | 3 | 0 | 0 | 03 |
| 6. | CS23102 | Operating Systems | 3 | 1 | 2 | 05 |

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| 7. | CS23103 | Microprocessors | 3 | 0 | 2 | 04 |
| 8. | CS23166 | Study Tour (Audit) | 0 | 0 | 0 | 00 |
| **Total** | | | | | | **23** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behaviour | 3 | 0 | 0 | 03 |
| 2. | MO230\*\* | Open Elective – I (From MOOC) | 3 | 0 | 0 | 03 |
| 3. | CS230\*\* | Programme Elective – I | 3 | 0 | 0 | 03 |
| 4. | CS230\*\* | Programme Elective – II | 3 | 0 | 0 | 03 |
| 5. | CS23200 | Compiler Design | 3 | 1 | 2 | 05 |
| 6. | CS23201 | Computer Networks | 3 | 1 | 2 | 05 |
| 7. | CS23289 | Seminar | 0 | 0 | 2 | 01 |
| **Total** | | | | | | **23** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | \*\*240\*\* | Open Elective – II | \* | \* | \* | 03 |
| 2. | CS240\*\* | Programme Elective – III | 3 | 0 | 0 | 03 |
| 3. | CS240\*\* | Programme Elective – IV | 3 | 0 | 0 | 03 |
| 4. | CS24199 | Project – I | 0 | 0 | 6 | 03 |
| 5. | CS24179 | Industrial Training | 0 | 0 | 0 | 03 |
| **Total** | | | | | | **15** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MO240\*\* | Open Elective – III (From MOOC) | 3 | 0 | 0 | 03 |
| 2. | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 03 |
| 3. | CS240\*\* | Programme Elective – V | 3 | 0 | 0 | 03 |
| 4. | CS240\*\* | Programme Elective – VI | 3 | 0 | 0 | 03 |
| 5. | CS24299 | Project – II | 0 | 0 | 12 | 06 |
| 6. | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 02 |
| **Total** | | | | | | **20** |

**List of Electives**

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| **Programme Electives – I & II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS23001 | Speech Processing | 3 | 0 | 0 | 03 |
| 2. | CS23002 | Graphics Design and Modelling | 3 | 0 | 0 | 03 |
| 3. | CS23003 | Computer Oriented Numerical Techniques | 3 | 0 | 0 | 03 |
| 4. | CS23004 | Software Engineering | 3 | 0 | 0 | 03 |
| 5. | CS23005 | Principles of Programming Languages | 3 | 0 | 0 | 03 |
| 6. | CS23006 | IOS Application Development | 3 | 0 | 0 | 03 |
| 7. | CS23007 | Computer Graphics | 3 | 0 | 0 | 03 |
| 8. | CS23008 | Data Communication | 3 | 0 | 0 | 03 |

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| **Programme Electives – III & IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS24001 | Soft Computing | 3 | 0 | 0 | 03 |
| 2. | CS24002 | Graph Theory | 3 | 0 | 0 | 03 |
| 3. | CS24003 | Real Time Systems | 3 | 0 | 0 | 03 |
| 4. | CS24004 | Information Security | 3 | 0 | 0 | 03 |
| 5. | CS24005 | Artificial Intelligence | 3 | 0 | 0 | 03 |
| 6. | CS24006 | Combinatorial Design Theory for Computer Science | 3 | 0 | 0 | 03 |
| 7. | CS24007 | Data Warehousing and Data Mining | 3 | 0 | 0 | 03 |
| 8. | CS24008 | Machine Learning | 3 | 0 | 0 | 03 |

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| **Programme Electives – V & VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS24011 | Grid Computing | 3 | 0 | 0 | 03 |
| 2. | CS24012 | Microprocessors and Micro-Controllers | 3 | 0 | 0 | 03 |
| 3. | CS24013 | Neural Imaging and Signal Systems | 3 | 0 | 0 | 03 |
| 4. | CS24014 | Wireless Communication | 3 | 0 | 0 | 03 |
| 5. | CS24015 | Distributed Algorithms | 3 | 0 | 0 | 03 |
| 6. | CS24016 | Operations Research | 3 | 0 | 0 | 03 |
| 7. | CS24017 | Mobile Application Development | 3 | 0 | 0 | 03 |
| 8. | CS24018 | Image Processing | 3 | 0 | 0 | 03 |
| 9. | CS24019 | Big Data Analytics | 3 | 0 | 0 | 03 |
| 10. | CS24020 | Human Computer Interaction | 3 | 0 | 0 | 03 |

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS24041 | Software Engineering Methodologies | 3 | 0 | 0 | 03 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CS24042 | Soft Computing for Engineers | 3 | 0 | 0 | 03 |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21104 | Oscillations, Waves and Optics | 4 | 0 | 2 | 05 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 04 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 05 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 03 |
| 5. | FR21121 | Biology for Engineers | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **20** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CY21201 | Engineering Chemistry – A | 3 | 1 | 2 | 05 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 04 |
| 3. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 04 |
| 4. | ES21251 | Workshop Practice | 0 | 0 | 6 | 03 |
| 5. | HS21201 | Communication Skills | 2 | 0 | 2 | 03 |
| 6. | ES21277 | Environmental Science (Audit) | 2 | 0 | 0 | 00 |
| **Total** | | | | | | **19** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 04 |
| 2. | ES22100 | Engineering Mechanics | 3 | 1 | 0 | 04 |
| 3. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 04 |
| 4. | EC22101 | Electronic Instrumentation and Measurements | 3 | 0 | 2 | 04 |
| 5. | EC22102 | Digital Electronics | 2 | 1 | 2 | 04 |
| 6. | EC22103 | Signals and Systems | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **23** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 03 |
| 2. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 00 |
| 3. | EC22201 | Microprocessors and Applications | 3 | 0 | 2 | 04 |
| 4. | EC22202 | Analog Communication Systems | 3 | 0 | 0 | 03 |
| 5. | EC22203 | Linear Integrated Circuits | 2 | 1 | 2 | 04 |
| 6. | EC22204 | Circuits and Devices | 2 | 1 | 2 | 04 |
| 7. | EE22221 | Power Electronics | 3 | 0 | 0 | 03 |
| **Total** | | | | | | **21** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23101 | Principles of Economics | 3 | 0 | 0 | 03 |
| 2. | HS23177 | Essence of Indian Knowledge and Tradition (Audit) | 2 | 0 | 0 | 00 |
| 3. | MA23101 | Applied Probability and Statistics | 3 | 0 | 0 | 03 |
| 4. | EC23101 | Digital Design using HDL | 2 | 1 | 2 | 04 |
| 5. | EC23102 | Digital Signal Processing | 3 | 0 | 2 | 04 |

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| 6. | EC23103 | Electromagnetic Theory | 3 | 0 | 0 | 03 |
| 7. | EC23104 | Control Systems | 3 | 0 | 0 | 03 |
| 8. | EC23166 | Study Tour (Audit) | 0 | 0 | 0 | 00 |
| **Total** | | | | | | **20** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behaviour | 3 | 0 | 0 | 03 |
| 2. | MO230\*\* | Open Elective – I (From MOOC) | 3 | 0 | 0 | 03 |
| 3. | EC230\*\* | Programme Elective – I | 3 | 0 | 0 | 03 |
| 4. | EC230\*\* | Programme Elective – II | 3 | 0 | 0 | 03 |
| 5. | EC23289 | Seminar | 0 | 0 | 2 | 01 |
| 6. | EC23201 | Digital Communications | 3 | 0 | 2 | 04 |
| 7. | EC23202 | Microwave Engineering | 3 | 0 | 2 | 04 |
| 8. | EC23203 | Microelectronics | 3 | 0 | 0 | 03 |
| **Total** | | | | | | **24** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | \*\*240\*\* | Open Elective – II | \* | \* | \* | 03 |
| 2. | EC240\*\* | Programme Elective – III | 3 | 0 | 0 | 03 |
| 3. | EC240\*\* | Programme Elective – IV | 3 | 0 | 0 | 03 |
| 4. | EC24101 | Antenna and Radar Engineering | 3 | 0 | 2 | 04 |
| 5. | EC24102 | VLSI Designs | 3 | 0 | 2 | 04 |
| 6. | EC24199 | Project – I | 0 | 0 | 6 | 03 |
| 7. | EC24179 | Industrial Training | 0 | 0 | 0 | 03 |
| **Total** | | | | | | **23** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
|  | MO242\*\* | Open Elective – III (From MOOC) | 3 | 0 | 0 | 03 |
|  | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 03 |
|  | EC240\*\* | Programme Elective – V | 3 | 0 | 0 | 03 |
|  | EC240\*\* | Programme Elective – VI | 3 | 0 | 0 | 03 |
|  | EC24299 | Project – II | 0 | 0 | 12 | 06 |
|  | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 02 |
| **Total** | | | | | | **20** |

**List of Electives**

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| **Programme Elective – I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC23001 | Network Analysis and Synthesis | 3 | 0 | 0 | 3 |
| 2. | EC23002 | Video and Advanced TV Engineering | 3 | 0 | 0 | 3 |
| 3. | EC23003 | Modern Control Engineering | 3 | 0 | 0 | 3 |
| 4. | EC23004 | Information Theory and Coding | 3 | 0 | 0 | 3 |
| 5. | EC23005 | Medical Electronics | 3 | 0 | 0 | 3 |
| 6. | EC23006 | Speech Processing | 3 | 0 | 0 | 3 |

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| **Programme Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC23011 | Microcontrollers and Applications | 3 | 0 | 0 | 3 |
| 2. | EC23012 | Computer Organization | 3 | 0 | 0 | 3 |
| 3. | EC23013 | Introduction to Plasmonics | 3 | 0 | 0 | 3 |
| 4. | EC23014 | Embedded Systems | 3 | 0 | 0 | 3 |
| 5. | EC23015 | Transducers and Signal Conditioning | 3 | 0 | 0 | 3 |
| 6. | EC23016 | Digital Image Processing | 3 | 0 | 0 | 3 |

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| **Programme Elective – III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24001 | Multimedia Communication and Networking | 3 | 0 | 0 | 3 |
| 2. | EC24002 | Telecommunication Switching | 3 | 0 | 0 | 3 |
| 3. | EC24003 | Optical Fiber Communication | 3 | 0 | 0 | 3 |
| 4. | EC24004 | Wireless Communication | 3 | 0 | 0 | 3 |
| 5. | EC24005 | Instrumentation and Process Control | 3 | 0 | 0 | 3 |
| 6. | EC24006 | Artificial Intelligence and Machine Learning | 3 | 0 | 0 | 3 |

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| **Programme Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24011 | Advanced Digital System Design | 3 | 0 | 0 | 3 |
| 2. | EC24012 | Semiconductor Device Modelling | 3 | 0 | 0 | 3 |
| 3. | EC24013 | Advanced Computer Architecture | 3 | 0 | 0 | 3 |
| 4. | EC24014 | Nano-electronics | 3 | 0 | 0 | 3 |
| 5. | EC24015 | Low Power VLSI Design | 3 | 0 | 0 | 3 |
| 6. | EC24016 | Advanced Digital Signal Processing | 3 | 0 | 0 | 3 |

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| **Programme Elective – V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24021 | Artificial Neural Network and its Applications | 3 | 0 | 0 | 3 |
| 2. | EC24022 | Modern Digital Communication Techniques | 3 | 0 | 0 | 3 |
| 3. | EC24023 | Satellite Communication | 3 | 0 | 0 | 3 |
| 4. | EC24024 | Computer Communication and Network | 3 | 0 | 0 | 3 |
| 5. | EC24025 | Wireless Sensor Networks | 3 | 0 | 0 | 3 |
| 6. | EC24026 | Radio Frequency Components and Circuits | 3 | 0 | 0 | 3 |

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| **Programme Elective – VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24031 | Analog Integrated Circuits | 3 | 0 | 0 | 3 |
| 2. | EC24032 | Digital Integrated Circuits | 3 | 0 | 0 | 3 |
| 3. | EC24033 | Computer Aided Design of VLSI Circuits | 3 | 0 | 0 | 3 |
| 4. | EC24034 | VLSI Digital Signal Processing Systems | 3 | 0 | 0 | 3 |
| 5. | EC24035 | CMOS Mixed Signal Circuits | 3 | 0 | 0 | 3 |
| 6. | EC24036 | VLSI implementation of DSP architecture | 3 | 0 | 0 | 3 |
| 7. | EC24037 | System and Data Security | 3 | 0 | 0 | 3 |
| 8. | EC24038 | Data Analytics | 3 | 0 | 0 | 3 |

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24041 | Electronic Circuits and Devices | 3 | 0 | 0 | 3 |
| 2. | EC24042 | Instrumentation and Measurements | 3 | 0 | 0 | 3 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EC24043 | Electronic Engineering Materials | 3 | 0 | 0 | 3 |

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| **ES22101** | **Basic Electronics Engineering: 4 Credits (3-0-2)** | |
| Unit I | Semiconductors and diode**:** Conduction in solids. Pure and doped semiconductor, Concept of holes, Electron and hole mobility, Band Diagram. | 6 lectures |
| Unit II | Diode: p-n junction diode, diode mechanism & I-V characteristics, Equivalent circuits of diodes, Avalanche and Zener effect, Zener diode, LED, Schottky diode. Application: Half wave and Full wave rectifier circuits, clipping and  clamping circuits, zener voltage regulator circuit. | 8 lectures |
| Unit III | Bipolar Junction Transistors: Operation of N-P-N and P-N-P transistors in active, saturation and cut-off modes. I-V characteristics, current and voltage gain in CE, CB and CC configuration. Transistor biasing circuits, and stability, ac dc load line  concept. | 10 lectures |
| Unit IV | Transistor AC Analysis: Low frequency and high frequency models for BJT, BJT Amplifiers, h parameters /r-parameter model, high frequency π model. Miller's  theorem. | 10 lectures |
| Unit V | Voltage regulators and Power Amplifiers: Series and Shunt voltage regulators. Introduction to Power amplifiers – Class A, B, AB, C, Push pull and Tuned amplifier. | 8 lectures |
| **Books:**   1. Physics of Semiconductor Devices, (S M Sze and Kwok K. Ng, 3rd Edition), Wiley-Interscience. 2. Solid State Electronic devices, Streetmann and Banerjee (7th Edition), Prentice Hall, 2014. 3. Millman & Halkias, “Integrated Electronics” (3rd Edition), Tata McGraw Hill. 4. Semiconductor Physics & Devices: Basic Principle, Donald A. Neaman, (3rd Edition), Tata McGraw Hill, New Delhi. 5. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky, 10th Edition, Pearson. 6. Electronics Principles By: A. P. Malvino, Tata McGraw Hill. | | |

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| **EC22101** | **Electronic Instrumentation and Measurements: 4 Credits (3-0-2)** | |
| Unit I | Generalized Measurement system: Accuracy, Precision, Fidelity, speed of response, static & dynamic performance characteristics, dynamic - step response, ramp response of first and second order instruments. Classifications  of errors, error analysis of measurement. | 8 lectures |

**DEPARTMENT OF ELECTRICAL ENGINEERING**

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| **Year I Semester I** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21105 | Introduction to Electromagnetic Theory | 4 | 0 | 2 | 05 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 04 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 05 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 03 |
| 5. | FR21121 | Biology for Engineers | 2 | 1 | 0 | 03 |
| **Total** | | | | | | **20** |

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| **Year I Semester II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | CY21201 | Engineering Chemistry – A | 3 | 1 | 2 | 5 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 4 |
| 3. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 4 |
| 4. | ES21251 | Workshop Practices | 0 | 0 | 6 | 3 |
| 5. | HS21201 | Communication Skills | 2 | 0 | 2 | 3 |
| 6. | ES21277 | Environmental Science (Audit) | 2 | 0 | 0 | 0 |
| **Total** | | | | | | **19** |

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| **Year II Semester III** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 4 |
| 2. | ES22100 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 3. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 4 |
| 4. | EE22101 | Analog Electronic Circuits | 3 | 0 | 2 | 4 |
| 5. | EE22102 | Electrical Circuit Analysis | 3 | 1 | 0 | 4 |
| 6. | EE22103 | Electrical Machines – I | 3 | 0 | 2 | 4 |
| **Total** | | | | | | **24** |

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| **Year II Semester IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE22201 | Microprocessors and its Applications | 3 | 0 | 2 | 4 |
| 2. | EE22202 | Power Systems – I | 3 | 0 | 2 | 4 |
| 3. | EE22203 | Electrical Machines – II | 3 | 0 | 2 | 4 |
| 4. | EE22204 | Power Electronics | 3 | 0 | 2 | 4 |
| 5. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 3 |
| 6. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 0 |
| **Total** | | | | | | **19** |

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| **Year III Semester V** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE23101 | Digital Electronics | 3 | 0 | 2 | 4 |
| 2. | EE23102 | Control Systems | 3 | 0 | 2 | 4 |
| 3. | EE23103 | Electromagnetic Fields | 3 | 1 | 0 | 4 |
| 4. | EE23104 | Power Systems – II | 3 | 0 | 2 | 4 |
| 5. | EE23105 | Signals and Systems | 2 | 1 | 0 | 3 |
| 6. | HS23101 | Principles of Economics | 3 | 0 | 0 | 3 |
| 7. | HS23177 | Essence of Indian Knowledge and Tradition (Audit) | 2 | 0 | 0 | 0 |
| 8. | EE23166 | Study Tour (Audit) | 0 | 0 | 0 | 0 |
| **Total** | | | | | | **22** |

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| **Year III Semester VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behavior | 3 | 0 | 0 | 3 |
| 2. | EE23201 | Switchgear and Protection | 3 | 0 | 2 | 4 |
| 3 | EE23202 | Electrical Measurements and Instrumentation | 3 | 0 | 2 | 4 |
| 4. | EE230\*\* | Programme Elective – I | 3 | 0 | 0 | 3 |
| 5. | EE230\*\* | Programme Elective – II | 3 | 0 | 0 | 3 |
| 6. | MO230\*\* | Open Elective – I (from MOOC) | 3 | 0 | 0 | 3 |
| 7. | EE23289 | Seminar | 0 | 0 | 2 | 1 |
| **Total** | | | | | | **21** |

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| **Year IV Semester VII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE24101 | Modern Control Engineering | 3 | 0 | 0 | 3 |
| 2. | EE240\*\* | Programme Elective – III | 3 | 0 | 0 | 3 |
| 3. | EE240\*\* | Programme Elective – IV | 3 | 0 | 0 | 3 |
| 4. | \*\*240\*\* | Open Elective – II | \* | \* | \* | 3 |
| 5. | EE24199 | Project – I | 0 | 0 | 6 | 3 |
| 6. | EE24179 | Industrial Training | 0 | 0 | 0 | 3 |
| **Total** | | | | | | **18** |

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| **Year IV Semester VIII** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE240\*\* | Programme Elective – V | 3 | 0 | 0 | 3 |
| 2. | EE240\*\* | Programme Elective – VI | 3 | 0 | 0 | 3 |
| 3. | MO240\*\* | Open Elective – III (from MOOC) | 3 | 0 | 0 | 3 |
| 4. | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 3 |
| 5. | EE24299 | Project – II | 0 | 0 | 12 | 6 |
| 6. | EE24288 | Extra-curricular Activities and Discipline | 0 | 0 | 0 | 2 |
| **Total** | | | | | | **20** |

**List of Electives**

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| **Programme Electives – I & II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE23001 | Advanced Power Electronics | 3 | 0 | 0 | 3 |
| 2. | EE23002 | Electrical Energy Management | 3 | 0 | 0 | 3 |
| 3. | EE23003 | Power System Stability | 3 | 0 | 0 | 3 |
| 4. | EE23004 | Computer Aided Design of Electrical Machines | 3 | 0 | 0 | 3 |
| 5. | EE23005 | Power System Economics | 3 | 0 | 0 | 3 |
| 6. | EE23006 | Extra HVDC/HVAC Transmission | 3 | 0 | 0 | 3 |
| 7. | EE23007 | Optimization Techniques and Engineering | 3 | 0 | 0 | 3 |
| 8. | EE23008 | Computer Application in Power Systems | 3 | 0 | 0 | 3 |
| 9. | EE23009 | Flexible AC Transmission Systems | 3 | 0 | 0 | 3 |

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| **Programme Electives – III & IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE24001 | High Voltage Engineering | 3 | 0 | 0 | 3 |
| 2. | EE24002 | Advanced Artificial Intelligence | 3 | 0 | 0 | 3 |
| 3. | EE24003 | Distributed Generations | 3 | 0 | 0 | 3 |
| 4. | EE24004 | Advanced Microprocessors and its Applications | 3 | 0 | 0 | 3 |
| 5. | EE24005 | Power System Instrumentation and Control | 3 | 0 | 0 | 3 |
| 6. | EE24006 | Special Electromechanical Systems | 3 | 0 | 0 | 3 |
| 7. | EE24007 | Power Electronics based Industrial Drives | 3 | 0 | 0 | 3 |
| 8. | EE24008 | Bio-Medical Instrumentation | 3 | 0 | 0 | 3 |
| 9. | EE24009 | Safety and Reliability Engineering | 3 | 0 | 0 | 3 |
| 10. | EE24010 | Network Synthesis | 3 | 0 | 0 | 3 |

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| **Programme Electives – V & VI** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE24021 | Time Series Analysis and Forecasting | 3 | 0 | 0 | 3 |
| 2. | EE24022 | Power System Reliability | 3 | 0 | 0 | 3 |
| 3. | EE24023 | CMOS VLSI Design | 3 | 0 | 0 | 3 |
| 4. | EE24024 | Microprocessor based Industrial Drives | 3 | 0 | 0 | 3 |
| 5. | EE24025 | Arduino Programing | 3 | 0 | 0 | 3 |
| 6. | EE24026 | Electric Vehicles | 3 | 0 | 0 | 3 |
| 7. | EE24027 | Energy Systems | 3 | 0 | 0 | 3 |
| 8. | EE24028 | Electrical Power Utilization and Illumination Engineering | 3 | 0 | 0 | 3 |

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE24041 | Renewable Energy and Applications | 3 | 0 | 0 | 3 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | EE24042 | Introduction to Nano-Biotechnology | 3 | 0 | 0 | 3 |

**DEPARTMENT OF MECHANICAL ENGINEERING**

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| **Year I** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | PH21102 | Introduction to Mechanics | 4 | 0 | 2 | 5 |
| 2. | MA21101 | Mathematics – I | 3 | 1 | 0 | 4 |
| 3. | ES21100 | Basic Electrical Engineering | 3 | 1 | 2 | 5 |
| 4. | ES21151 | Engineering Graphics and Design | 0 | 0 | 6 | 3 |
| 5. | FR21121 | Biology for Engineers | 2 | 1 | 0 | 3 |
| **Total** | | | | | | **20** |

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| **Year I** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS21201 | Communication Skills | 2 | 0 | 2 | 3 |
| 2. | MA21201 | Mathematics – II | 3 | 1 | 0 | 4 |
| 3. | CY21202 | Engineering Chemistry – B | 3 | 1 | 2 | 5 |
| 4. | ES21200 | Programming for Problem Solving | 3 | 0 | 2 | 4 |
| 5. | ES21251 | Workshop Practice | 0 | 0 | 6 | 3 |
| 6. | ES21277 | Environmental Science (Audit) | 2 | 0 | 0 | 0 |
| **Total** | | | | | | **19** |

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| **Year II** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MA22101 | Mathematics – III | 3 | 1 | 0 | 4 |
| 2. | ES22100 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 3. | ES22101 | Basic Electronics Engineering | 3 | 0 | 2 | 4 |
| 4. | ME22101 | Engineering Metallurgy | 3 | 0 | 0 | 3 |
| 5. | ME22102 | Thermodynamics | 3 | 1 | 0 | 4 |
| 6. | ME22151 | Machine Drawing | 0 | 0 | 6 | 3 |
| **Total** | | | | | | **22** |

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| **Year II** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS22201 | Entrepreneurship and Startups | 3 | 0 | 0 | 3 |
| 2. | HS22277 | Indian Constitution (Audit) | 2 | 0 | 0 | 0 |
| 3. | ME22201 | Applied Thermodynamics | 3 | 1 | 0 | 4 |
| 4. | ME22202 | Fluid Mechanics and Machines | 3 | 1 | 2 | 5 |
| 5. | ME22203 | Strength of Materials | 3 | 0 | 2 | 4 |
| 6. | ME22204 | Theory of Machines | 3 | 0 | 2 | 4 |
| **Total** | | | | | | **20** |

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| **Year III** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23101 | Principles of Economics | 3 | 0 | 0 | 3 |
| 2. | HS23177 | Essence of Indian Knowledge and Tradition | 2 | 0 | 0 | 0 |

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| 3. | ME23101 | Heat Transfer | 3 | 0 | 2 | 4 |
| 4. | ME23102 | Mechanics of Solids | 3 | 0 | 0 | 3 |
| 5. | ME23103 | Manufacturing Processes | 4 | 0 | 2 | 5 |
| 6. | ME23104 | Design of Machine Elements | 3 | 0 | 2 | 4 |
| 7. | ME23105 | Instrumentation and Control | 3 | 0 | 2 | 4 |
| 8. | ME23166 | Study Tour (Audit) | 0 | 0 | 0 | 0 |
| **Total** | | | | | | **23** |

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| **Year III** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS23201 | Organizational Behaviour | 3 | 0 | 0 | 3 |
| 2. | ME23201 | Manufacturing Technology | 4 | 0 | 2 | 5 |
| 3. | ME23202 | Machine Design | 3 | 0 | 2 | 4 |
| 4. | ME230\*\* | Programme Elective – I | 3 | 0 | 0 | 3 |
| 5. | ME230\*\* | Programme Elective – II | 3 | 0 | 0 | 3 |
| 6. | MO230\*\* | Open Elective – I (From MOOC) | 3 | 0 | 0 | 3 |
| 7. | ME23289 | Seminar | 0 | 0 | 2 | 1 |
| **Total** | | | | | | **22** |

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| **Year IV** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24101 | Automation in Manufacturing | 3 | 0 | 0 | 3 |
| 2. | ME24102 | Mechanical Vibrations | 3 | 0 | 0 | 3 |
| 3. | ME240\*\* | Programme Elective – III | 3 | 0 | 0 | 3 |
| 4. | ME240\*\* | Programme Elective – IV | 3 | 0 | 0 | 3 |
| 5. | \*\*240\*\* | Open Elective – II | \* | \* | \* | 3 |
| 6. | 24179 | Industrial Training | 0 | 0 | 0 | 3 |
| 7. | 24199 | Project – I | 0 | 0 | 6 | 3 |
| **Total** | | | | | | **21** |

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| **Year IV** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24201 | Energy Conversion Techniques | 3 | 0 | 0 | 3 |
| 2. | ME240\*\* | Programme Elective – V | 3 | 0 | 0 | 3 |
| 3. | ME240\*\* | Programme Elective – VI | 3 | 0 | 0 | 3 |
| 4. | MO240\*\* | Open Elective – III (From MOOC) | 3 | 0 | 0 | 3 |
| 5. | \*\*240\*\* | Open Elective – IV | \* | \* | \* | 3 |
| 6. | ME24299 | Project – II | 0 | 0 | 1 | 6 |
| 7. | ED24288 | Extra-Curricular Activities and Discipline | 0 | 0 | 0 | 2 |
| **Total** | | | | | | **23** |

**List of Electives**

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| **Programme Elective – I** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME23001 | Power Plant Engineering | 3 | 0 | 0 | 3 |
| 2. | ME23002 | Two Phase Flow and Heat Transfer | 3 | 0 | 0 | 3 |

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| 3. | ME23003 | Boundary Layer Theory | 3 | 0 | 0 | 3 |
| 4. | ME23004 | Fluid Power Control Systems | 3 | 0 | 0 | 3 |
| 5. | ME23005 | Refrigeration and Air-conditioning | 3 | 0 | 0 | 3 |

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| **Programme Elective – II** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME23011 | Non-Conventional Machining | 3 | 0 | 0 | 3 |
| 2. | ME23012 | Industrial Robotics | 3 | 0 | 0 | 3 |
| 3. | ME23013 | Composite Materials | 3 | 0 | 0 | 3 |
| 4. | ME23014 | Production Planning and Control | 3 | 0 | 0 | 3 |

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| **Programme Elective – III** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24001 | Internal Combustion Engines | 3 | 0 | 0 | 3 |
| 2. | ME24002 | Combustion Engineering | 3 | 0 | 0 | 3 |
| 3. | ME24003 | Compressible Flow | 3 | 0 | 0 | 3 |
| 4. | ME24004 | Heat Exchanger Design | 3 | 0 | 0 | 3 |
| 5. | ME24005 | Energy Management | 3 | 0 | 0 | 3 |

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| **Programme Elective – IV** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24011 | Numerical Control and CAM | 3 | 0 | 0 | 3 |
| 2. | ME24012 | Management of Production Systems | 3 | 0 | 0 | 3 |
| 3. | ME24013 | Total Quality Management | 3 | 0 | 0 | 3 |
| 4. | ME24014 | Intelligent Manufacturing Systems | 3 | 0 | 0 | 3 |

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| **Programme Elective – V** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24021 | Numerical Analysis | 3 | 0 | 0 | 3 |
| 2. | ME24022 | Principles of Tribology | 3 | 0 | 0 | 3 |
| 3. | ME24023 | Engineering Materials | 3 | 0 | 0 | 3 |
| 4. | ME24024 | Computer Aided Design and Graphics | 3 | 0 | 0 | 3 |

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| **Programme Elective – VI** | | | | | | |
| **S. N.** | **Course** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | ME24031 | Finite Element Methods | 3 | 0 | 0 | 3 |
| 2. | ME24032 | Fracture Mechanics | 3 | 0 | 0 | 3 |
| 3. | ME24033 | Theory of Elasticity | 3 | 0 | 0 | 3 |
| 4. | ME24034 | Rotor Dynamics | 3 | 0 | 0 | 3 |

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| . 1. | ME24041 | Non-Conventional Energy Source | 3 | 0 | 0 | 3 |
| . 2. | ME24042 | Operations Research | 3 | 0 | 0 | 3 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| . 1. | ME24043 | Mechatronics Systems | 3 | 0 | 0 | 3 |
| . 2. | ME24044 | Wind and Solar Energy Systems | 3 | 0 | 0 | 3 |

**DEPARTMENT OF CHEMISTRY**

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| **CY21101** | **Plant Biochemistry: 2 Credits (1-0-2)** | |
| Unit I | Chemistry of carbohydrates: classification, mono, di and poly saccharides, anomerism, epimerism, mutarotation, configuration of sugars and inversion. | 2 lectures |
| Unit II | Chemistry of lipids: classification, simple lipids and phospholipids. Fatty acids and fat constants, lipids of chloroplast, membrane lipids. | 3 lectures |
| Unit III | Chemistry of amino acids, peptides and proteins: classification, levels of protein structure. Chemistry of nucleic acids – N bases, sugars; Enzymes – classification, enzyme kinetics, enzyme inhibition, allosteric enzymes, lysozymes, coenzymes. | 3 lectures |
| Unit IV | Metabolism of carbohydrates: glycolysis, TCA cycle, HMPshunt, glyoxylic acid  cycle, electron transport chain. Lipids metabolism – beta oxidation and fatty acid biosynthesis. | 3 lectures |
| Unit V | Photosynthesis: light reaction, dark reaction, Hill’s reaction, photo respiration, C4 pathway, C3 and C4 plants, CO2 fixation, regulation of photosynthesis. Plant hormones and their mode of action. | 3 lectures |
| **Books:**   1. Conn, E.E. and Stumpf, P.K. (1989). Outlines of Biochemistry, Wiley Eastern Ltd., New Delhi. 2. Mazur, A. and Harrows, B. (1971). Text book of Biochemistry. W.B. Sanders Publications, New Delhi. 3. Robert, C.B. (1983). Modern Concepts in Biochemistry. Allyn and Bacon Inc., London. 4. William, H.E. and Daphne, C.E. (2005). Biochemistry and Molecular Biology, Oxford University Press. 5. Lehninger, Nelson, D.L. and Michael, M.C. (2004), Principles of Biochemistry, Freeman Publishers. | | |

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| **CY21202** | **Engineering Chemistry – B: 5 Credits (3-1-2)** | |
| Unit I | Water Technology: Boiler feed water-hardness, its units and determination; scale and sludge formation, boiler corrosion, caustic embrittlement, priming, foaming and their prevention. Conditioning (internal and external): phosphate, carbonate and Calgon conditioning; sodalime, zeolite and ion-exchange  processes. Municipal water, water treatment (purification, coagulation, filtration and disinfection) for municipal supply. | 10 lectures |
| Unit II | Metallurgy: General methods of extraction of metals, Extraction of Iron, Aluminium and Germanium. Alloys and their significance: Composition,  properties and uses of stainless steel, Invar, Alnico, Tungsten Steel, Brass, Bronze, Gun metal, Duralumin, Magnalium and Soft solders. | 10 lectures |
| Unit III | Corrosion and its prevention: Definition, theories of corrosion (chemical and electrochemical) and their mechanism. Factors affecting the rate of corrosion. Prevention of corrosion. | 7 lectures |
| Unit IV | Macromolecules: Classification, addition and condensation polymers, molecular weight of polymers (Mn, Mw, Mv), glass transition temperature (Tg), structure - property relationship in polymers (Chemical, electrical, optical and mechanical),  examples and uses of inorganic polymers, synthesis of some commercially important polymers and their uses (Nylon 66, Nylon 6, PE, PET, PS). | 10 lectures |
| Unit V | Spectroscopy: Fundamentals of spectroscopic techniques, basic principles of electronic and vibrational spectroscopy. | 5 lectures |
| **Books:**   1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and M. S. Pathania, 48th Edition, 2019, Vishal Publishing Co., Jalandhar. 2. Physical Chemistry, P. W. Atkins, 10th Ed., 2014, Oxford University Press, ELBS Ed., London. 3. A Text Book of Engineering Chemistry, S. S. Dara, 2013, S. Chand & Company Ltd., New Delhi. 4. Engineering Chemistry, B. Sivashankar, 2008, Tata McGraw-Hill Publishing Company Limited, New Delhi. 5. Engineering Chemistry, P. C. Jain and Monica Jain, 16th Ed., 2014, Dhanpat Rai and Co. Pvt. Ltd., Delhi. 6. Polymer Science, 1st Ed., 1986, V. R. Gowarikar, N. V. Wishwanathan and J. Sreedhar, Wiley-Eastern Ltd., New Delhi. | | |

1. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash, 4th Ed., 2017, Tata McGraw Hill, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Ed., 2003, Dhanpat Rai and Co. Pvt. Ltd., New Delhi.

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| **CY21201** | **Engineering Chemistry – A: 5 Credits (3-1-2)** | |
| Unit I | Macromolecules: Classification, addition and condensation polymers, molecular weight of polymers (Mn, Mw, Mv), glass transition temperature (Tg), structure - property relationship in polymers (Chemical, electrical, optical, and mechanical), examples and uses of inorganic polymers, synthesis of some commercially important polymers and their uses (Nylon 66, Nylon 6, PE, PET,  PS). | 10 lectures |
| Unit II | Chemical Kinetics: Rate of reactions, Factors influencing rate of reactions, Molecularity and order of reaction, Rate expression and examples of first and second order reactions. Kinetics of chain reactions, parallel reactions, side reactions, kinetics of catalytic action (biological catalysis), application of catalyst in industrially important processes (Haber’s process, Ostwald  process, Bergius process). | 8 lectures |
| Unit III | Corrosion and its prevention: Definition, theories of corrosion (chemical and  electrochemical) and their mechanism. Factors affecting the rate of corrosion. Prevention of corrosion. | 7 lectures |
| Unit IV | New Materials: Nanomaterials-Introduction, preparation (Synthesis-top down and bottom-up approaches), properties and applications of nanomaterials. Types, Properties and application of fullerenes, carbon nanotubes and nanowires. Nanoelectronics. Applications of nanomaterials in catalysis, telecommunication and medicine. E-Waste and its Management: E-Waste – Definition, sources of e-waste, hazardous substances in e-waste, effects of e- waste on environment and human health, need for e-waste management, e- waste handling rules, waste minimization techniques for managing e-waste, recycling of e-waste, disposal treatment methods of e- waste, global Scenario  of E-waste, E-waste in India – case studies. | 12 lectures |
| Unit V | Spectroscopy: Fundamentals of spectroscopic techniques, basic principles of electronic and vibrational spectroscopy. | 5 lectures |
| **Books:**   1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and M. S. Pathania, 48th Edition, 2019, Vishal Publishing Co., Jalandhar. 2. Physical Chemistry, P. W. Atkins, 10th Ed., 2014, Oxford University Press, ELBS Ed., London. 3. A Text Book of Engineering Chemistry, S. S. Dara, 2013, S. Chand & Company Ltd., New Delhi. 4. Engineering Chemistry, B. Sivashankar, 2008, Tata McGraw-Hill Publishing Company Limited, New Delhi. 5. Engineering Chemistry, P. C. Jain and Monica Jain, 16th Ed., 2014, Dhanpat Rai and Co. Pvt. Ltd., Delhi. 6. Polymer Science, 1st Ed., 1986, V. R. Gowarikar, N. V. Wishwanathan and J. Sreedhar, Wiley- Eastern Ltd., New Delhi. 7. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash, 4th Ed., 2017, Tata McGraw Hill, New Delhi. 8. Palanisamy P. N., Manikandan P., Geetha, A., Manjula Rani, K. and Kowshalya V. N., Environmental Science, Revised Edition, Pearson Education, New Delhi, 2019. 9. Ludovico Cadimartiri and Geoffrey A. Ozin, Concepts of Nanochemistry, Wiley-VCH, 2009. 10. C.N.R. Rao, A. Muller and A.K. Cheetham, The Chemistry of Nanomaterials, Wiley – VCH Verlag GmbH & Co., 2004. | | |

**DEPARTMENT OF MATHEMATICS**

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| **MA21102** | **Basic Mathematics: 2 Credits (2-0-0)** | |
| Unit I | Elementary idea of complex number; Arithmetic progression (AP). Geometric progression (GP): General term and sum of n terms. | 5 lectures |
| Unit II | Elementary idea of permutation and combination; Binomial theorem for positive integral index; Any index and their applications. | 5 lectures |
| Unit III | Trigonometric functions, sum and difference formulae; Sum to product,  product to sum formula; Trigonometrical ratios of multiple; sub multiple and compound angle. | 5 lectures |
| Unit IV | Function: algebraic, trigonometrical and exponential functions. Limit: properties of limit. Differentiation: product rule, quotient rule, chain rule, differentiation of trigonometrical function, logarithmic function. Maxima and Minima: simple application of maxima and minima. Integration: Integration of  simple functions. Methods of integration and properties. | 7 lectures |
| Unit V | Matrix: Operation of matrix. Determinant: properties of determinant; Solution of simultaneous linear equations by matrix method. | 6 lectures |
| **Books:**   1. Chatterjee, S.K. (1970). Mathematical Analysis. Oxford & IBH. 2. Frank, A. (1962). Schaum’s Outline of Theory and Problems of Matrices. McGraw-Hill. 3. Frank, A. (1967). Theory and Problems of Differential Equations. McGraw-Hill. 4. Gentle, J.E. (2007). Matrix Algebra: Theory, Computations and Applications in Statistics. Springer. 5. Narayan, S. (1953). A Text Book of Matrices. S. Chand and Company. 6. Parameswaran, S. (1976). An introduction to mathematics. Oxford & IBH Publishing Co. 7. Priestley, H.A. (1985). Introduction to Complex Analysis. Clarenton Press. 8. Walter, R. (1976). Principles of Mathematical Analysis. McGraw-Hill. | | |

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| **MA21202** | **Statistical Methods and Experimental Designs: 3 Credits (2-0-2)** | |
| Unit I | Basic concepts: Types and sources of data, classification and tabulation of data. Construction of frequency distribution tables: grathical representation of data, simple, multiple components and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average and measures of location; mean, median, mode; percentiles and quadrilles for raw and grouped data. Dispersion: Range, standard deviation, variance,  coefficient of variation for raw and grouped data. | 6 lectures |
| Unit II | Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poisson and normal distributions. | 5 lectures |
| Unit III | Test of significance: basic concepts, tests for equality of means, independent and paired t-tests, Chi square tests for application of attributes and test for goodness to fit. | 5 lectures |
| Unit IV | Correlation: scatter diagram, correlation co-efficient and its properties,  regression, fitting of sample linear regression, tests of significance of correlation and regression co-efficient. | 6 lectures |
| Unit V | Introduction to design of experiment, basic principles of experimental design-replication, randomization and local control; Analysis of variance- assumptions-construction of ANOVA table-conclusions based on ANOVA; Comparisons based on means-critical difference, DMRT; Transformations of data square root, logarithmic and angular transformations. Completely randomized design: layout, analysis, advantages and limitations; Randomised block design: layout, analysis, choice of no. of blocks,  advantages and limitations. Latin square designs: layout, analysis, applications, advantages and limitations. | 6 lectures |

**Books:**

1. Anderson, R.L. and Banercxft, T.A. (1952). Statistical Theory in Research. Mc. Graw Hill Book Co., New Work.
2. Cochran, W.G. and Cox, G.M. (1958). Experimental Designs. Wiley, New York.
3. Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments. Wiley Eastern Ltd., New Delhi.
4. Federer, W.T. (1955). Experimental Design. Macmillan, New York.
5. Gomez, K.A. and Gomz A.A. (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons. New York.
6. Kempthorne, O. (1952). The Design and Analysis of Experiments. Wiley, New Work.
7. Nigam, A.K. and Gupta, V.K. (1979). Hand Book on Analysis of Agricultural Experiments. IASRI Publication. New Delhi.
8. Panse, V.G. and Skhatme, P.V. (1967). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi.
9. Petersen Roger G. (1994). Agricultural Field Experiments: Design and Analysis. Marcel Dekker, New York.

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| **MA21101** | **Mathematics – I: 4 Credits (3-1-0)** | |
| Unit I | Successive differentiation, Leibnitz theorem, L. Hospital’s rule, Limit, Continuity and differentiability of functions of two and three variables,  partial differentiation, Euler’s theorem for homogenous function. Maxima and Minima of function of two variables, Lagrange’s multipliers. | 10 lectures |
| Unit II | Infinite series: Comparison test, Ratio test, Cauchy’s nth root test, Raabe’s  test power series, radius of convergence, Taylor’s and Maclaurin’s series, curvature, curve tracing. | 8 lectures |
| Unit III | Applications of definite integral, area between curves, length of a plane curve, surface area of revolution, volume of solids of revolution, Beta and Gamma functions. | 9lectures |
| Unit IV | Solution of linear, exact differential equations, differential equation of order  one but not of first degree, solvable by x, y, p., application of first order ordinary differential equations. | 7 lectures |
| Unit V | Types of matrices, elementary operations; Echelon form; normal form, rank of a matrix, solution of system of linear equations, eigen values and eigen vectors, Cayley-Hamilton theorem, diagonalization. | 8 lectures |
| **Books:**   1. A Text Book of Engineering Mathematics, N.P. Bali and M. Goyal, Laxmi Publications, 2014. 2. Schaum's Outline of Vector Analysis, M.R. Spiegel, 2009. 3. Engineering Mathematics, K.A. Stroud, Industrial Press Inc., 2013. 4. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finey, Addison Wesley, 1996. 5. Linear Algebra, G. Hadley, Narosa, Reprint 2002. | | |

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| **MA21201** | **Mathematics – II: 4 Credits (3-1-0)** | |
| Unit I | Linear differential equation of higher order with constant and variable coefficients, method of variation of parameters, Cauchy Euler’s and Legendre’s equations, series solution of ordinary differential equations with  special emphasis on Legendre’s and Bessel’s differential equations; application of linear differential equation of second order. | 10 lectures |
| Unit II | Fourier Series: Periodic function, Fourier series of a function with 2π period and arbitrary period, Fourier series of even and odd functions, half range Fourier sine and cosine series. | 8 lectures |
| Unit III | Laplace transform and its properties; existence theorem; Laplace transform  of derivatives, inverse Laplace transform; convolution theorem, use of Laplace transform in solving differential equations. | 8 lectures |
| Unit IV | Fourier integral, Fourier transform, Fourier sine and cosine transforms and  their elementary properties, applications of Fourier transforms in boundary value problems. | 8 lectures |

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| Unit V | Introduction to Z-transform and its convergence, Properties of Z-transform. Inverse Z-transform by Partial Fraction Method, Power Series Expansion, Convolution theorem. | 8 lectures |
| **Books:**   1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 1999. 2. Calculus and Analytical Geometry, G.B. Thomas and R.L Finney, Pearson, 2019. 3. Differential equations, S.L. Rose, Wiley. 4. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Narosa Publishing House, 2016. 5. Higher Engineering Mathematics, B.S. Grewal, Khanna Publications, 1965. | | |

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| **MA22101** | **Mathematics – III: 3 Credits (3-1-0)** |  |
| Unit I | Introduction to limit, continuity and differentiability of complex function;  analytic functions, singularity; Cauchy-Riemann equations, complex integration; Cauchy’s integral theorem, Calculus of residues. | 10 lectures |
| Unit II | Multiple integral: double and triple integrals, change of order of integration, change of variables, application of double and triple integrals. | 7 lectures |
| Unit III | Vector Calculus**:** Gradient of a scalar point function, divergence and curl of  a vector field, line and surface integrals; Green’s theorem, Gauss’s theorem; Stoke’s theorem. | 8 lectures |
| Unit IV | Introduction to partial differential equations, formation of PDE and solution of first order PDE by Lagrange’s method; solution of 2nd order linear partial  differential equations by separation of variables, heat, wave and Laplace’s equations; application of Fourier transforms in PDE. | 9 lectures |
| Unit V | Random variables; discrete and continuous random variables, probability mass function and probability density function; probability distribution- Binomial, Poisson and normal distributions. | 8 lectures |
| **Books:**   1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 1999. 2. A Text Book of Engineering Mathematics, N.P. Bali and M. Goyal, Laxmi Publications, 2014. 3. Ordinary and Partial Differential Equations, M.D. Raisinghania, S. Chand & Company, 2005. 4. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, Delhi, 2000. | | |

**DEPARTMENT OF PHYSICS**

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| **PH21101** | **Engineering Physics: 5 Credits (4-0-2)** | |
| Unit I | Dia, para and ferromagnetism-classification, Langevin theory of dia and paramagnetism, Adiabatic demagnetization, Weiss molecular field theory  and ferromagnetism, Curie-Weiss law. | 8 lectures |
| Unit II | Wave particle quality, de-Broglie concept, uncertainty principle, Wave function, Time dependent and time independent Schrodinger wave equation. | 8 lectures |
| Unit III | Qualitative explanation of Zeeman effect, Stark effect and Paschen-Back effect, Raman Spectroscopy. | 8 lectures |
| Unit IV | Statement of Bloch’s function, bands in solids, velocity of Bloch’s electron and effective mass, Distinction between metals, insulators and semiconductors, Donor and acceptor levels, Superconductivity, critical magnetic field, Meissner effect, Isotope effect, Type-I and II superconductors, Josephson’s effect DC and AC, Squids, Introduction to  high Tc superconductors. | 16 lectures |
| Unit V | Illumination: laws of illumination, luminous flux, luminous intensity, candle power, brightness, Spontaneous and stimulated emission, Einstein A and B coefficients, Population inversion, He-Ne and Ruby lasers, Ammonia and Ruby masers, Holography-Note, Optical fiber, Physical structure, basic theory, Mode type, input output characteristics of optical fiber and  applications. | 16 lectures |
| **Books:**   1. Text Book of Optics, Brijlal and Subrahmanyam, S. Chand and Co., New Delhi. 2. Optical State Physics and Fiber Optics, Sarkar Subit Kumar, S. Chand and Co., New Delhi. 3. Elements of Spectroscopy, Gupta S.L., Kumar V, Sharma RC, Pragati Prakashan, Meerut. 4. Concept of Physics, H.C. Verma, Volume 2, Bharati Bhawan Publishers. 5. Engineering Physics, D.K. Bhattacharya and T. Poonam, Oxford University Press. | | |

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| **PH21102** | **Introduction to Mechanics: 5 Credits (4-0-2)** | |
| Unit I | Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton’s laws and its completeness in describing particle motion; Form invariance of Newton’s Second Law; Solving Newton’s equations of motion in polar coordinates; Problems including constraints and friction;  Extension to cylindrical and spherical coordinates. | 12 lectures |
| Unit II | Potential energy function; E = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and  energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite manoeuvres. | 10 lectures |
| Unit III | Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum. Harmonic oscillator, Damped harmonic motion – over-damped, critically damped and lightly-damped  oscillators; Forced oscillations and resonance. | 10 lectures |
| Unit IV | Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler’s laws of motion, their independence from Newton’s laws, and their necessity  in describing rigid body motion; Examples. | 10 lectures |
| Unit V | Introduction to three-dimensional rigid body motion – only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity  vector, and its rate of change and (b) Moment of inertia tensor; Three- | 14 lectures |

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|  | dimensional motion of a rigid body wherein all points move in a coplanar manner, e.g., Rod executing conical motion with centre of mass fixed – only need to show that this motion looks two-dimensional but is three-  dimensional, and two dimensional formulation fails. |  |
| **Books:**   1. Engineering Mechanics, M. K. Harbola, Cengage; 2nd ed., 2013. 2. Introduction to Mechanics, M. K. Verma, Universities Press India Private Limited, 2nd ed., 2016. 3. An Introduction to Mechanics, D. Kleppner and R. Kolenkow, Cambridge University Press, 2nd ed., 2013. 4. Mechanics, J. P. Den Hartog, Dover Publications Inc., 2003. 5. Engineering Mechanics – Dynamics, J. L. Meriam, LG Kraige and J.N. Bolton, 8th ed., Wiley, 2018. 6. Mechanical Vibrations, J. P. Den Hartog, Dover Publications Inc., 1985. | | |

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| **PH21103** | **Quantum Mechanics for Engineers: 5 Credits (4-0-2)** | |
| Unit I | Introduction to Quantum mechanics, Wave nature of Particles, Free-particle wave function and wave-packets, Uncertainty principle, Time-dependent and  time-independent Schrodinger’s equation, Born interpretation, probability current density, Expectation values. | 10 lectures |
| Unit II | Complex numbers, Linear vector spaces, inner product, operators, eigenvalue problems, Hermitian operators, Hermite polynomials, Legendre’s equation, spherical harmonics. | 8 lectures |
| Unit III | Solution of stationary-state Schrodinger equation for one-dimensional problems – particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Numerical solution of stationary-state Schrodinger equation for one-dimensional problems for different potentials. Scattering from a potential barrier and tunnelling; related examples like alpha-decay, field-ionization and scanning tunnelling microscope. Three-dimensional problems: particle in three-dimensional box and related examples, Angular momentum operator, Rigid Rotor, Hydrogen atom ground-state, orbitals, interaction with magnetic field, spin. Numerical solution stationary-state radial Schrodinger equation for spherically  symmetric potentials. | 18 lectures |
| Unit IV | Particle in double delta-function potential, Molecules (hydrogen molecule,  valence bond and molecular orbitals picture), singlet/triplet states, chemical bonding, hybridization. | 10 lectures |
| Unit V | Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Numerical solution for energy in one-dimensional periodic lattice by mixing plane  waves. | 10 lectures |
| **Books:**   1. Quantum Physics, R. Eisberg and R. Resnick, John Wiley & Sons, 2nd ed., 1985. 2. Quantum Mechanics, G. Aruldhas, Prentice Hall India Learning Private Limited, 2nd ed., 2008. 3. Quantum Mechanics:Theory and Applications, A.Ghatak and S.Lokanathan, Macmillan Publisher, 2012. 4. Quantum mechanics, D. J. Griffiths, Cambridge India, 2016. 5. Introduction to Solid State Physics, C. Kittel, Wiley, 8th ed., 2012. | | |

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| **PH21104** | **Oscillations, Waves and Optics: 5 Credits (4-0-2)** | |
| Unit I | Mechanical and electrical simple harmonic oscillators; complex number notation and phasor representation of simple harmonic motion; damped harmonic oscillator-heavy, critical and light damping; energy decay in a damped harmonic oscillator; quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of  forced damped harmonic oscillator, power absorbed by oscillator. | 10 lectures |

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| Unit II | Transverse wave on a string, equation of wave on a string, harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigenfrequencies, longitudinal waves and wave equation for them, acoustics waves and speed of sound, standing sound  waves; waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity. | 10 lectures |
| Unit III | Fermat’s principle of stationary time and its applications, e.g., in explaining mirage effect, laws of reflection and refraction, light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster’s angle, total internal reflection and evanescent wave. Mirrors, lenses and  optical instruments based on them, transfer formula of matrix method. | 14 lectures |
| Unit IV | Huygens’ principle, superposition of waves and interference of light by  wavefront splitting and amplitude splitting, Young’s double-slit experiment, Newton’s rings, Michelson interferometer, Mach-Zehnder interferometer. | 10 lectures |
| Unit V | Einstein’s theory of matter radiation interaction, Einstein A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (Ruby, Neodymium), dye lasers; properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in  science, engineering and medicine. | 12 lectures |
| **Books:**   1. Ian G. Main, Oscillations and Waves in physics, Cambridge University Press, 3rd ed., 1993. 2. H. J. Pain, The physics of vibrations and waves, Wiley, 6th ed., 2006. 3. E. Hecht, Optics, Pearson, 4th ed., 2001. 4. A. Ghatak, Optics, McGraw Hill Education India Private Limited, 6th ed., 2017. 5. O. Svelto, Principles of lasers, Springer, 5th ed., 2010. | | |

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| **PH21105** | **Introduction to Electromagnetic Theory: 5 Credits (4-0-2)** | |
| Unit I | Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace’s and Poisson’s equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Boundary conditions of electric  field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field. | 10 lectures |
| Unit II | Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement;  Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab. | 10 lectures |
| Unit III | Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes theorem. Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility  and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials. | 12 lectures |
| Unit IV | Faraday’s law in terms of EMF produced by changing magnetic flux; equivalence of Faraday’s law and motional EMF; Lenz’s law; Electromagnetic breaking and its applications; Differential form of Faraday’s law expressing curl  of electric field in terms of time-derivative of magnetic field; energy stored in a magnetic field. | 10 lectures |
| Unit V | Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; Maxwell’s equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of  energy and Poynting vector with examples. The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; | 14 lectures |

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|  | relation between electric and magnetic fields of an electromagnetic wave;  energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. |  |
| **Books:**   1. Introduction to Electrodynamics, David Griffiths, Cambridge University Press, 4th ed., 2020. 2. Electricity and Magnetism, D.C. Tayal, Himalaya Publishing House, 2014. 3. Physics, D. Halliday, R. Resnick and K. S. Krane**,** Wiley India Pvt. Ltd., 5th ed., 2017. 4. Introduction to Electromagnetic Theory, P. C. Clemmow, Cambridge University Press, 1973. | | |

**DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES**

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | HS24041 | Managing Stress | 3 | 0 | 0 | 3 |
| 2. | HS24042 | Human Resource Management | 3 | 0 | 0 | 3 |
| 3. | HS24043 | Project Formulation, Analysis and its Management | 3 | 0 | 0 | 3 |
| 4. | HS24044 | Engineering Ethics | 3 | 0 | 0 | 3 |

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| **HS21101** | **Communication Skills and Personality Development: 3 Credits (2-0-2)** | |
| Unit I | Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and  note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. | 6 lectures |
| Unit II | Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu  presentation, public speaking; Group discussion. Organizing seminars and conferences, Text – I, Text – II. | 6 lectures |
| Unit III | Applied Grammar: Introduction to Word Classes. Structure of the Verb in English. Uses of Tenses. Study of Voice. | 6 lectures |
| Unit IV | Use of Conjunctions and Prepositions. Sentence Patterns in English. Spoken English: Conversations of Different Situations in Everyday Life. | 6 lectures |
| Unit V | The Concept of Stress, Stress Shift in Words and Sentences. Words with Silent Letters and their Pronunciations. The Basic Intonation Patterns. | 4 lectures |
| **Books:**   1. Carroll, B.J. (1986). English for college, Macmillan India Ltd. New Delhi. 2. Hahn, “The Internet complete reference”, TMH. 3. Hornby, A.S. (1975). Guide to patterns and usage in English. Oxford University, New Delhi. 4. Qurik, R and Green Baum, S. (2002). A University grammar. | | |

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| **HS23102** | **Entrepreneurship Development and Business Management: 2 Credits (2-0-0)** | |
| Unit I | Entrepreneurship Development: Assessment of business environment; Overview of social, political and economic systems for entrepreneurs in India; Globalization and the emerging business / entrepreneurial environment. | 5 lectures |
| Unit II | Concept of entrepreneurship and characteristics of entrepreneurs; Motivation for  entrepreneurship development; Importance of planning, monitoring, evaluation and follow-up for managing competition; entrepreneurship development programs. | 6 lectures |
| Unit III | Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/SSIs. Public-  private partnerships. Social Responsibility of Business organizations. | 5 lectures |
| Unit IV | Export and Import Policies relevant to forestry sector. Contract farming and  joint ventures; Overview of forestry inputs industry. Characteristics of Indian forestry processing and export industry. | 5 lectures |
| Unit V | SWOT Analysis; Developing leadership skills, developing managerial skills, problem solving skill; Project planning formulation and Project Report preparation; Supply chain management and Total quality management. | 7 lectures |
| **Books:**   1. Entrepreneurship: Starting a new Business, Anderson, Allied Publishers Ltd., New Delhi, 1991. 2. Entrepreneurship Development, Colombo Plan Staff College for Technician Education, Manila, Tata McGraw Hill, New Delhi, 1998. 3. Maslow, A.H., Motivation and personality, Harper and Row Publishers, New York, 1970. 4. Perelson, B. and Steiner, G., Human behaviour, Harcourt Brace Jovanovich, New York, 1964. | | |

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| **HS23202** | **Forest Economics and Marketing: 3 Credits (3-0-0)** | |
| Unit I | Meaning of Economics; Divisions of economics; Importance of economics; Forest Economics; Meaning and importance of Goods, service, utility, value, price, wealth, growth and development. | 8 lectures |
| Unit II | Theory of consumption; Utility and Indifference curve theory; Consumer surplus; Demand and supply theory; Types of markets; Market structures;  Market equilibrium. | 9 lectures |
| Unit III | Elasticity of demand and supply; Importance of elasticity of demand and supply for pricing of timber and non-timber products; Economics of timber and non- timber forest products; Forest planning–forest policy and development;  Production theory and factor rewards of factors of production. | 8 lectures |
| Unit IV | National Income; Concepts of Public finance; Inflation: deflection; Welfare economics; Meaning of Marketing; Marketing Process and its role. | 9 lectures |
| Unit V | Basic guidelines and Techno-economic parameters for preparation of project proposals; SWOT analysis for business venture selection; Preparation of Bankable projects for forest and agri-based products projects; Identification of  marketing channels for new products. | 8 lectures |
| **Books:**   1. Dewett, K. K., Modern Economic Theory, S. Chand, New Delhi, 2005. 2. Dewett, K. K., Verma, Elementary Economic Theory, S. Chand, New Delhi, 2004. 3. Jhingan, M. L., Macro Economic Theory, Vrinda Publishers, New Delhi, 2012. 4. Reddy, S. S., Raghu Ram, P., Neelakanta Sastry, T. V., Bhavani, D.I., Agricultural Economics, Oxford and IBH Publishers, New Delhi, 2004. | | |

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| **HS23203** | **Marketing of Non-Timber Forest Products: 3 Credits (2-0-2)** | |
| Unit I | Meaning of timber and non-timber forest produce (NTFP); Features and types of timber and non-timber forest produce and their markets; Price determination of timber and non-timber forest produce. | 5 lectures |
| Unit II | Economic features of timber markets in terms of degree and type of competition; Cost and prices of pre-commercial thinning, commercial thinning, harvesting, hauling, sawing, transportation, treatment of wood, carpentry, and other processing activities involved in teakwood, rosewood, matchwood, pulpwood, sandalwood, veneers; Domestic demand and trade in timber and  non-timber forest products. International demand and trade in timber and non- timber forest produce. | 6 lectures |
| Unit III | Demand forecasting; Economic features of specialized markets in terms of degree and type of competition for bamboo, canes, lac, gums, resins, hides and skins. Services of saw mill and other intermediate wood processing industries. | 6 lectures |
| Unit IV | Economics of processing pulp to paper/poly fiber; wood to plywood/veneers. Economics of gathering medicinal plants from forests, economics of processing medicinal plants. Role of cooperative societies in marketing of timber and non-  timber forest produce. | 6 lectures |
| Unit V | Economic Policy and Regulations of international timber trade. Essentials of World Trade Organization, GATT, Dunkel proposals, Intellectual Property Rights and Patenting. International Timber Trade Organization (ITTO) and  timber certification. | 5 lectures |
| **Books:**   1. Gray, J. W. (1993). Forest resource systems in Developing Countries. Food and agricultural organization. Rome. 2. ITTO. [International Tropical Timber Organisation]. (1993). The economic linkages between international trade in tropical timber and sustainable management of tropical forests. London environmental economic centre, International Institute for Environment and Development, London, UK. 3. ITTO. [International Tropical Timber Organisation]. (2012). Annual review and assessment of the world timber situation, Yogyakarta, Indonesia. | | |

1. Kula, E. (1996). The economics of forestry: Modern theory and practice. Timber Press, Portland, Oregon.
2. Muraleedharan, P. K., Subramanian, K. K., and Pillai, P. P. (1998). Basic readings in Forest Economics. Kerala Forest Research Institute and Ford Foundation, Thrissur, Kerala.
3. Tewari, D. N. (1995). Marketing and trade of forest produce. International Book Distributors (Book Sellers & Publishers), Dehradun, India.

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| **HS21201** | **Communication Skills: 3 Credits (2-0-2)** | |
| Unit I | Applied Grammar and Usage; Parts of Speech, Sentence Construction,  Subject-Verb-Agreement in English; Tenses, Voice; Punctuation and Vocabulary; Idioms and Figures of Speech. | 6 lectures |
| Unit II | Communication Skills: Concepts and Types; Language and Communication; Meaning and Process of Communication, Verbal and Non-verbal  Communication; Reading Writing and Listening Skills. Accent, Pitch, Pronunciation and Basic Intonation Patterns; Conversation. | 6 lectures |
| Unit III | Reading and Comprehension: Characteristics and types of Essays; Text I (General/Personal/Technical essay) for detailed study. | 6 lectures |
| Unit IV | Reading and Comprehension: Characteristics and types of Short Stories/Fiction; Text II (Short Story/Fiction) for detailed study. | 5 lectures |
| Unit V | Writing Skills: Precís Writing, Summarizing and Abstracting; Field Diary and Laboratory Record; Indexing, Footnote, Endnote, Bibliographic Format and  Referencing; Note Taking and Report Writing. | 5 lectures |
| **Books:**   1. Carroll, B. J. 1986. English for College. Macmillan India Ltd., New Delhi. 2. Hahn, “The Internet complete reference”, TMH. 3. Hornby, A. S. 1975. Guide to Patterns and Usage in English. Oxford University, New Delhi. 4. Qurik, R. and Green baum, S. 2002. A University Grammar. Pearson, New Delhi. | | |

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| **HS22201** | **Entrepreneurship and Startups: 3 Credits (3-0-0)** | |
| Unit I | Definition, Importance of entrepreneurship. Entrepreneurial values and attitudes; Innovativeness, risk-taking and analytical ability. Entrepreneurial motivation, Characteristics of entrepreneurs. Types of entrepreneurs, Rural  entrepreneurship and women entrepreneurship. | 8 lectures |
| Unit II | Launching a new Business Venture: Identification of investment opportunities, Project formulation, Project screening, Market analysis and demand Forecasting. Technical, Environmental and Managerial analysis of project  proposals. | 9 lectures |
| Unit III | Project Appraisal; Means of financing and working results estimation, Ratio  Analysis, Depreciation of Assets, Break-even analysis, Qualitative methods for Project evaluation, Social Cost Benefit Analysis. | 8 lectures |
| Unit IV | Financial Analysis; Pay-back period, Net Present Value Estimation, IRR calculation, Cost-benefit analysis. | 9 lectures |
| Unit V | Definition of Start-up; Features of start-up, Start-up of India Programmes and its importance in Indian economy, Essentials of start-up schemes. SWOT Analysis, External environment of business venture, Socio-economic, political  environment for undertaking starting self-employment schemes, Preservation of environment and improvement in the quality of life in rural economy. | 8 lectures |
| **Books:**   1. Project Preparation, Evaluation & Implementation, P. Chandra, Tata McGraw Hill, New Delhi, 1996. 2. Agri-Business and Entrepreneurship, Rajgopal, Indian Books & Periodicals, New Delhi, 1991. 3. Entrepreneurship: Starting a new Business, Anderson, Allied Publishers Ltd, New Delhi, 1991. 4. Entrepreneurship Development, Colombo Plan Staff College for Technician Education, Manila, Tata McGraw Hill, New Delhi, 1998. | | |

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| **HS22277** | **Indian Constitution: 0 Credits (2-0-0)** | |
| Unit I | The Constitution – Introduction; The History of the Making of the Indian Constitution; Preamble and the Basic Structure, and its interpretation; Fundamental Rights and Duties and their interpretation; State Policy Principles. | 5 lectures |
| Unit II | Union Government; Structure of the Indian Union; President – Role and Power; Prime Minister and Council of Ministers; Lok Sabha and Rajya Sabha. | 6 lectures |
| Unit III | State Government; Governor – Role and Power; Chief Minister and Council of Ministers; State Secretariat. | 6 lectures |
| Unit IV | Local Administration; District Administration; Municipal Corporation; Zila Panchayat. | 6 lectures |
| Unit V | Election Commission; Role and Functioning; Chief Election Commissioner; State Election Commission. | 5 lectures |
| **Books:**   1. Ethics and Politics of the Indian Constitution, Rajeev Bhargava Oxford University Press, New Delhi, 2008. 2. The Constitution of India, B. L. Fadia, Sahitya Bhawan, New edition, 2017. 3. Introduction to the Constitution of India, D. D. Basu, Lexis Nexis, Twenty-Third edition, 2018.   **Websites:**   * 1. https://[www.constitution.org/cons/india/const.html](http://www.constitution.org/cons/india/const.html)   2. <http://www.legislative.gov.in/constitution-of-india>   3. https://[www.sci.gov.in/constitution](http://www.sci.gov.in/constitution)   4. https://[www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/](http://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/) | | |

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| **HS23101** | **Principles of Economics: 3 Credits (3-0-0)** | |
| Unit I | Definition, of Economics, Scope of economics, Micro vs. Macroeconomics, Basic Economic problems of the economy, Production Possibility Curve of an Economy, Laws of Supply and Demand. General market equilibrium, Elasticity  of demand. | 8 lectures |
| Unit II | Consumers' Behaviour; Utility Analysis. Indifference curve analysis and consumers’ equilibrium. Applications of IC Analysis. | 8 lectures |
| Unit III | Theory of production; Laws of Production, Optimal use of Factors of Production, Producer’s Equilibrium, Cost concept and types of costs. Cost of production, supply functions, cost and revenue functions. | 10 lectures |
| Unit IV | Price and output determination and Producers’ equilibrium under different market situations in short-run and long-run, Price discriminating monopoly. | 8 lectures |
| Unit V | Pricing of Factors of Production; Interest, wage, rent and profit; National Income; Business Cycle; Exchange rate; Inflation & Deflation. | 8 lectures |
| **Books:**   1. Microeconomic Analysis – R. R. Barthwal, Wiley Eastern Ltd. New Delhi, 1991. 2. Principles of Microeconomics – D. D. Tewari and K. Singh, New Age International, New Delhi, 1996. 3. Microeconomics – Kourtsoyanis, ELBS, McMillan, London, 1985. 4. Principles of Economics – M. L. Seth and L. N. Agrawal, Educational Publication, Agra, 1995. 5. Economics – P. A. Samuelson and W. D. Nordhaus, Tata McGraw Hill Publications, New Delhi, 2002. | | |

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| **HS23177** | **Essence of Indian Knowledge and Tradition: 0 Credits (2-0-0)** | |
| Unit I | Basic Structure of Indian Knowledge System. | 5 lectures |
| Unit II | Modern Science and Indian Knowledge System. | 6 lectures |
| Unit III | Yoga and Holistic Health care. | 6 lectures |
| Unit IV | Case Studies. | 6 lectures |
| Unit V | Case Studies. | 5 lectures |
| **Books:**   1. Cultural Heritage of India - Course Material, V. Sivaramakrishna, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014. 2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan. | | |

1. The wave of Life, Fritzof Capra.
2. Tao of Physics, Fritzof Capra.
3. Tarkasangraha of Annam Bhatta, V. N. Jha, Chinmay Inernational Foundation, Velliarnad, Ernakulam.
4. Science of Consciousness, Psychotherapy and Yoga Practices, R. N. Jha, Vidyanidhi Prakasham, Delhi, 2016.

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| **HS23201** | **Organizational Behaviour: 3 Credits (3-0-0)** | |
| Unit I | Fundamentals of organizations - Nature of people and Organizations, Forces affecting organizational behaviour, Changing work force and employment  relations, Impact of globalization and Information technology on organizational behaviour, Organizational climate and culture. | 8 lectures |
| Unit II | Individual dimensions in organizational behaviour-Individual differences; Theories of Personality, Perception - Perceptual process and impression management. Learning-theories of learning and implications for management. | 8 lectures |
| Unit III | Communication- Concept, Process, Barriers and their remedies; Leadership- Theories and Styles. Implications for different stakeholders. | 9 lectures |
| Unit IV | Theories and implications of Motivation, Work place emotions - Job satisfaction, designing effective jobs, Job-rotation enrichment, enlargement and reengineering work process, job related causes of stress, fatigue and its impact on productivity. Employee counselling and other psychological measures to  improve productivity and mental health. | 9 lectures |
| Unit V | Groups and group dynamics, group behavior, group dynamics theories and group cohesiveness - group decision making process, understanding work teams, team Vs groups, team development, Ingredients of effective teams, team  life cycle, inter-personal skills - Johari Window and transactional analysis. | 8 lectures |
| **Books:**   1. Organizational Behaviour – Robbins, S. P., Judge, T. A. and Vohra, N., Pearson, India, 2018. 2. Organizational Behaviour – Luthans, Fred, Mc Graw Hill, International Edition, 2013. 3. Organisational Behaviour – Rao, V. S. P, Excel Books, New Delhi, 2012. 4. Developing Managerial skills in Organizational Behaviour – Mainiero, Lisa A. and Tromley, Chery L., Printice Hall India, New Delhi, 2009. 5. Organizations: structures, processes and outcomes – Hall Tolbert, PHI, New Delhi, 2010. 6. Behaviour in organizations: Understanding and managing the human side of work – Jerald Greenderg, Baron, PHI, 2008. | | |

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| **HS24041** | **Managing Stress: 3 Credits (3-0-0)** | |
| Unit I | The stress process: Concept of stress, current and historical status; The nature of the stress response. | 8 lectures |
| Unit II | Common sources of stress - biological, personality, and environmental. | 9 lectures |
| Unit III | Coping styles - defensive behaviour and problem solving. | 8 lectures |
| Unit IV | Consequences of stress - medical, Psychological, and behavioural. The role of social support in mitigating stress. | 8 lectures |
| Unit V | Stress Management Techniques - relaxation, meditation, cognitive restructuring, self-control, bio-feedback, and time management. | 9 lectures |
| **Books:**   1. Stress and Coping: The Indian Experience, D. M. Pestonjee, Sage Publication, New Delhi, 1999. 2. Controlling Stress and Tension, D. Girdano and G. Everly, Prentice Hall of India, New Delhi, 1996. 3. Adjustment: Applying Psychology in a Complex World, R. S. Feldman, McGraw International, New York, 1989. | | |

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| **HS24042** | **Human Resources Management: 3 Credits (3-0-0)** | |
| Unit I | HRM, Definition, Scope, HRM vs. Personnel Management, Functions of HRM in changing environment. | 9 lectures |
| Unit II | Human Resource Planning, Recruitment, Selection, Induction and Placement. | 8 lectures |
| Unit III | Training, Executive Development, Career and Succession Planning. | 7 lectures |
| Unit IV | Motivation Job description, enrichment, analysis and Evaluation, Performance Appraisal. | 8 lectures |
| Unit V | Industrial Relations Scenario in India, Trade Unionism, Collective Bargaining,  Industrial Conflict Resolution, Industrial democracy and workers participation in Management. | 10 lectures |
| **Books:**   1. Human Resource Management, DeCenzo, D. A., Robbins S. P., and Verhulst, S. L., Wiley India, New Delhi, 2015. 2. Human Resource Management, Mirza S. Sayadin, Tata McGraw Hill, New Delhi, 2000. 3. Human Resource Management, K. Ashwathappa, McGraw Hill Education, 2017. 4. Personnel Management, C. B. Manoria, Himalayan Publishing House, New Delhi, 1995. | | |

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| **HS24043** | **Project Formulation, Analysis and its Management: 3 Credits (3-0-0)** | |
| Unit I | Definition of Project, Identification of Investment opportunities, Preliminary report and feasibility report preparation, Project screening and Criteria for selection of a  project, Commercial, Technical, Financial and Socio-Economic study of project proposals. | 8 lectures |
| Unit II | Project Evaluation; Time value of money, Non Discounting and Discounting criteria of Project evaluation; Net Present value estimation, Pay-back period, Internal Rate of Return, Benefit-Cost ratio etc. | 8 lectures |
| Unit III | Estimation of working results, Profitability projection, Cash flow statement and analyses, Risk and uncertainty analysis. | 8 lectures |
| Unit IV | Social Cost Benefit Analysis, UNIDO approach. Little Mirlee Approach. | 8 lectures |
| Unit V | Network Technique; Critical Path Method, Programme Evaluation Review Technique, Management of Manpower, Decision making, Auditing of projects etc. | 10 lectures |
| **Books:**   1. Project Preparation, Evaluation & Implementation, P. Chandra, Tata McGraw Hill, New Delhi, 1996. 2. Agri-Business and Entrepreneurship, Rajgopal, Indian Books & Periodicals, New Delhi, 1991. 3. Entrepreneurship: Starting a new Business, Anderson, Allied Publishers Ltd., New Delhi, 1991. 4. Entrepreneurship Development, Colombo Plan Staff College for Technician Education, Manila, Tata McGraw Hill, New Delhi, 1998. | | |

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| **HS24044** | **Engineering Ethics: 3 Credits (3-0-0)** | |
| Unit I | Scope and Aims of Engineering Ethics: What is Engineering Ethics? Why study Engineering Ethics? Morality, Mental Health and Executive Success. | 8 lectures |
| Unit II | Moral Moral Reasoning and Ethical Theories: Professional ideas and virtues. | 9 lectures |
| Unit III | Values **–** the vital core of psychological growth: Values, Self-esteem, and Managerial Effectiveness. | 8 lectures |
| Unit IV | The Ontological Foundation of Ethical management; The Nature of the Personas the basis of human Management. | 9 lectures |
| Unit V | Engineers as Managers, Consultants, and Leaders. | 8 lectures |
| **Books:**   1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2012. 2. John R. Boatright, “Ethics and the conduct of Business”, Pearson Education, New Delhi, 2012. 3. Ethics in Engineering – M. W. Martin and R. Schinzingler, Tata McGraw Hill, New Delhi, 1997. 4. Managerial Dilemma and Executive Growth – F. V. Manning, Reston Publishing Co. | | |

**CENTRE FOR MANAGEMENT STUDIES**

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| **Open Elective – II** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| 1. | MB24041 | Time Series Analysis | 3 | 0 | 0 | 3 |
| 2. | MB24042 | Entrepreneurship in Renewable Energy | 3 | 0 | 0 | 3 |

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| **Open Elective – IV** | | | | | | |
| **S. N.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credit** |
| . 1. | MB24043 | Marketing Management | 3 | 0 | 0 | 3 |

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| **MB24041** | **Time Series Analysis: 3 (3-0-0)** | |
| Unit I | Understanding the characteristics of time series data, Stochastic process and its main characteristics: Stochastic process. Time series as a discrete stochastic process. Stationarity. Main characteristics of stochastic processes (means, auto-covariation and autocorrelation functions). Stationary stochastic processes. Stationarity as the main characteristic of stochastic component of time series. Wold decomposition. Lag operator.  Exploratory Data Analysis: Trends in time series data, Using smoothing and removing trends when working with time series data. Understanding how periodograms are used with time series data. | 9 lectures |
| Unit II | Autoregressive-moving average models: Understanding moving average models and partial autocorrelation as foundations for analysis of time series data, ARMA (p,q) Moving average models МА(q). Condition of invertability. Autoregressive models АR(р). Yull-Worker equations. Stationarity conditions. Autoregressive-moving average models ARMA (p,q). Coefficient estimation in ARMA (p,q) processes: Box-Jenkins’ approach Coefficients estimation in autoregressive models. Coefficient estimation in ARMA (p) processes. Quality of adjustment of time series models. AIC information criterion. BIC information criterion. “Portmonto”-statistics. Box-Jenkins methodology to identification of stationary time series models. Forecasting in the framework of Box-Jenkins model: Forecasting, trend and seasonality in Box-Jenkins model. | 9 lectures |
| Unit III | The unit root problem: The unit root problem. Spurious trends and regressions. Unit root tests (Dickey-Fuller). ADF test and the choice of the number of lags. Other unit root tests. Regressive dynamic models: Regressive dynamic models. Autoregressive models with distributed lags (ADL). | 9 lectures |
| Unit IV | Using ARCH and AR class of models in multivariate time series contexts, Using spectral density estimation and spectral analysis, Using fractional differencing and threshold models with time series data. | 6 lectures |
| Unit V | Vector auto-regression model and co-integration: Time series co-integration. Co-integration regression. Testing of co-integration. Vector autoregression and co-integration. Co-integration and error correction model. Causality in time series: Granger causality. Hypothesis testing on rational expectations. Hypothesis testing on market efficiency. | 9 lectures |
| **Books:**   1. Applied Time series analysis: Walter Enders, Willey. 2. Econometrics: Greene, PHI. | | |

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| **MB24042** | **Entrepreneurship in Renewable Energy: 3 Credits (3-0-0)** | |
| Unit I | Need and importance of Entrepreneurship in Renewable Energy, Energy Conservation Act 2003, Indian Electricity Regulation Act on deregulation, Government schemes and initiatives for the promotion of Renewable Energy. | 9 lectures |
| Unit II | Company incorporation process, Preparation of Journal, Ledger, Bank Reconciliation Statement, Special Ledger, Balance Sheet, Profit and Loss  Account, Cost Sheet, Cash Flow. | 8 lectures |
| Unit III | Facility Location, Layout, Optimisation Planning in Renewable Energy, Tools and Techniques: Linear programming, Transportation, Assignment, Scheduling. | 9 lectures |
| Unit IV | Project management in Renewable Energy, Time value of money, impact of Compounding, Critical Path Method (CPM), Program Evaluation and Review  Techniques (PERT), Sources of financing. | 8 lectures |
| Unit V | Marketing Mix, Market segmentation, Technology Development Life Cycle,  Energy Marketing, Intellectual Property Right, Human Resource Planning, Legal aspects of Human Resource Management. | 8 lectures |
| **Books:**   1. Entrepreneurship: Rajiv Roy, OUP. 2. Accountancy: Hanif, Mukherjee, TMH. 3. Financial Managment: I.M. Pandey, Vikash Publishing. 4. Production and Operations Management: K. Bedi, OUP. 5. Operations Research: Paneerselvan, PHI. 6. Electricity deregulation: Loi, Lai, Lei, IEEE Press. 7. Websites of Ministry of Power, NABARD, World Bank, etc. | | |

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| **MB24043** | **Marketing Management: 3 Credits (3-0-0)** | |
| Unit I | Understanding Marketing Management, Marketing in a Developing Economy, Marketing of Services. | 9 lectures |
| Unit II | Marketing Planning and Organisation, Planning Marketing Mix, Market Segmentation, Marketing Organisations, Marketing Research and its applications. | 9 lectures |
| Unit III | Marketing Environment and Consumers, Determinants of Consumer Behaviour, Models of Consumer Behaviour, Indian Consumer Behaviour. | 9 lectures |
| Unit IV | Marketing offerings, Product Decisions and Strategies, Product Lifecycle and New Product Development, Branding and Packaging Decisions, Pricing Policies and practices. | 6 lectures |
| Unit V | Promotion and Distributions, Marketing Communications, Advertising, Publicity,  Personal Selling and Sales Promotion, Sales Forecasting, Distribution Strategy, Managing Sales Personnel. | 9 lectures |
| **Books:**  1. Marketing Management - A South Asian Perspectives – Kotler, Keller, Koshy, Jha, Pearson. | | |