

**1.1.1: Curricula developed and implemented have relevance to the local, regional, national, and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes(COs) of the Programmes offered by the institution**



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# PEOs, PSOs & COs



## GRBT-19 B.Tech (Civil Engineering)

### Department Vision:

To be the best Civil Engineering department in the region by means of good teaching, research and consultancy that serves the society.

### Department Mission:

- Arranging field visits, guest lectures and interactive sessions with subject experts
- Creating a strong bond between industrial needs and academic research outcomes
- Undertaking collaborative projects which offer opportunities for long-term interaction between academia and industry
- Promoting the career of the faculty members by encouraging their research work
- Adopting best teaching practices, imparting employability skills and empowering to become entrepreneurs in the trade.

### Program Educational Objectives (PEOs):

|      |                                                                                                                                                          |
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| PEO1 | Learning new technologies and/or undertaking higher education.                                                                                           |
| PEO2 | Leading a team of engineers in executing projects.                                                                                                       |
| PEO3 | An entrepreneur in civil engineering community and/or a leadership role exhibiting systematic approach to resolve societal problems with ethical values. |

### Program Educational Objectives (PSOs):

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| PSOs | <ul style="list-style-type: none"> <li>• PSO1: Get proficiency in management and communication skills to become an entrepreneur.</li> <li>• PSO2: Ability to use earth sciences in execution of civil engineering projects.</li> </ul> |
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### Program Outcomes (POs): Engineering Graduates will be able to:

- PO-1. Apply knowledge of computing, mathematics, science and engineering basics related to Civil Engineering.
- PO-2. Identify the problems and analyse the solutions by simulating, conducting experiments and interpreting data.
- PO-3 Design civil engineering structures to meet industrial needs.
- PO-4 Explore and investigate contemporary engineering problems and proposed solutions.
- PO-5 Use latest techniques, skills and modern machinery for engineering practices.
- PO-6 Propose civil engineering solutions to solve societal problems.
- PO-7 Design sustainable systems in congruence with social and environmental issues.
- PO-8 Practice professional ethics with legal awareness and societal responsibilities.
- PO-9 Work as an individual or in a team to achieve targets.
- PO-10 Articulate thoughts and ideas effectively at different levels.
- PO-11 Manage financial and human resources for better execution of project.
- PO-12 Participate in lifelong learning process.

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| Course outcomes for First Year First Semester Course |                                                                                                                                                                                                                                                                                                                                                              |
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| <b>Course Code: 19198101</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Mathematics - I</b>                 |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                 | Transform the knowledge of solving system of linear equations using matrices.                                                                                                                                                                                                                                                                                |
| CO2:                                                 | Apply mean value Rolls, LaGrange's and Cauchy mean value theorem in engineering applications.                                                                                                                                                                                                                                                                |
| CO3:                                                 | Acquire the knowledge maxima and minima of function of several variables.                                                                                                                                                                                                                                                                                    |
| CO4:                                                 | Evaluate multiple integrals and their applications.                                                                                                                                                                                                                                                                                                          |
| CO5:                                                 | Understand and apply vector derivatives and vector integration theorems.                                                                                                                                                                                                                                                                                     |
| <b>Course Code: 19198102</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Communicative English I</b>         |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                 | Students will be able to develop effective reading strategies                                                                                                                                                                                                                                                                                                |
| CO2:                                                 | Will be able to demonstrate writing skills that are required for professional development and use graphic elements for communication.                                                                                                                                                                                                                        |
| CO3:                                                 | Will be able to apply grammatical skills and vocabulary effectively in speech and writing.                                                                                                                                                                                                                                                                   |
| <b>Course Code: 19198103</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Chemistry</b>           |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                 | Compare different types of cells                                                                                                                                                                                                                                                                                                                             |
| CO2:                                                 | Explain the merits of fuel cells                                                                                                                                                                                                                                                                                                                             |
| CO3:                                                 | List of various sources of renewable energy                                                                                                                                                                                                                                                                                                                  |
| CO4:                                                 | Distinguish between polymers and plastics                                                                                                                                                                                                                                                                                                                    |
| CO5:                                                 | Distinguish between nano clusters & nanowires, polymers.                                                                                                                                                                                                                                                                                                     |
| <b>Course Code: 19198205</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Physics</b>             |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                 | To impart knowledge of physical optical phenomenon like Interference, Diffraction and polarization involving design of optical instruments with higher resolution. To explain the concept of dielectric constant and polarization in dielectric materials and summarize Gauss's law in the presence of dielectrics                                           |
| CO2:                                                 | To interpret dielectric loss, Lorentz field and Clausius- Menotti relation and classify the magnetic materials based on susceptibility and their temperature dependence. To apply the Gauss' Theorem for divergence and Stokes' Theorem for curl and evaluate Maxwell's displacement current and correction in Ampere's law.                                 |
| CO3:                                                 | To assess the electromagnetic wave propagation in different media and its power and explain the working principle of optical fibres and its classification based on refractive index profile and mode of propagation with their applications. To classify the energy bands of semiconductors and outline the properties of n-type and p-type semiconductors. |
| CO4:                                                 | To study the basic Quantum mechanics, interpretation of the direct and indirect band gap in semiconductors and identify the type of semiconductor using Hall effect.                                                                                                                                                                                         |
| <b>Course Code: 19198212</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Physics Laboratory</b>  |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                 | To handle optical instruments like microscope and spectrometer, determining thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colours using diffraction grating                                                                                                                     |
| CO2:                                                 | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance                                                                                                                                              |
| CO3:                                                 | To evaluate the acceptance angle of an optical fibre and numerical aperture and determine the resistivity of the given semiconductor using four probe method                                                                                                                                                                                                 |

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| CO4:                                                         | To identify the type of semiconductor i.e., n-type or p-type using Hall effect and determine the band gap of a given semiconductor               |
| <b>Course Code: 19198111</b>                                 |                                                                                                                                                  |
| <b>Course Title: Communicative English Laboratory</b>        |                                                                                                                                                  |
| CO1:                                                         | Learning to communicate in English                                                                                                               |
| CO2:                                                         | Comprehend native speaker's accent                                                                                                               |
| CO3:                                                         | Speak appropriately in real life situations                                                                                                      |
| <b>Course Code: 19198112</b>                                 |                                                                                                                                                  |
| <b>Course Title: Engineering Chemistry Laboratory</b>        |                                                                                                                                                  |
| CO1:                                                         | Explain the functioning of the instruments such as pH, conductivity and potentiometric meters                                                    |
| CO2:                                                         | Determine the total hardness of water                                                                                                            |
| CO3:                                                         | Perform various redox titrations                                                                                                                 |
| CO4:                                                         | Preparation of polymers                                                                                                                          |
| CO5:                                                         | Compare viscosities of different oils                                                                                                            |
| <b>Course outcomes for First Year Second Semester Course</b> |                                                                                                                                                  |
| <b>Course Code: 19198201</b>                                 |                                                                                                                                                  |
| <b>Course Title: Mathematics – II</b>                        |                                                                                                                                                  |
| CO1:                                                         | Solve first order differential equations.                                                                                                        |
| CO2:                                                         | Solve higher order differential equations with constant coefficients                                                                             |
| CO3:                                                         | Apply the knowledge of approximating and find the roots of polynomial and transcendental equation in practical engineering problems.             |
| CO4:                                                         | Understand numerical differentiation and integration.                                                                                            |
| CO5:                                                         | Apply the knowledge of different algorithms for approximating the solution of ordinary differential equations in practical engineering problems. |
| <b>Course Code: 19198112</b>                                 |                                                                                                                                                  |
| <b>Course Title: Engineering Chemistry Laboratory</b>        |                                                                                                                                                  |
| CO1:                                                         | Explain the functioning of the instruments such as pH, conductivity, and potentiometric meters.                                                  |
| CO2:                                                         | Determine the total hardness of water                                                                                                            |
| CO3:                                                         | Perform various redox titrations.                                                                                                                |
| CO4:                                                         | Preparation of polymers                                                                                                                          |
| CO5:                                                         | Compare viscosities of different oils                                                                                                            |
| <b>Course outcomes for Second Year First Semester Course</b> |                                                                                                                                                  |
| <b>Course Code: 19110302</b>                                 |                                                                                                                                                  |
| <b>Course Title: Strength of Materials</b>                   |                                                                                                                                                  |
| CO 1:                                                        | explain the basic materials behaviour under the influence of different external loading conditions and the support conditions                    |
| CO 2:                                                        | draw the diagrams indicating the variation of the key performance features like bending moment and shear forces.                                 |
| CO 3:                                                        | calculate the section modulus and determine of stressed developed in the beams due to various loading conditions                                 |
| CO 4:                                                        | assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure                  |
| CO 5:                                                        | determine the forces beams subjected to distributed loads                                                                                        |
| <b>Course Code: 19110303</b>                                 |                                                                                                                                                  |
| <b>Course Title: Environmental Engineering</b>               |                                                                                                                                                  |

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| CO 1:                                                                   | plan and design the water and distribution networks and sewerage systems.                                                                                                                                              |
| CO 2:                                                                   | identify the water source and select proper intake structure.                                                                                                                                                          |
| CO 3:                                                                   | asses the water quality                                                                                                                                                                                                |
| CO 4:                                                                   | select the appropriate appurtenances in the water supply.                                                                                                                                                              |
| CO 5:                                                                   | select the suitable treatment flow for raw water treatments.                                                                                                                                                           |
| <b>Course Code: 19110304</b>                                            |                                                                                                                                                                                                                        |
| <b>Course Title: Construction Materials, Equipment &amp; Management</b> |                                                                                                                                                                                                                        |
| CO 1:                                                                   | describe the types and properties of various building materials -stones, clay products, Timber, metals, cement and concrete and their applications in building industry                                                |
| CO 2:                                                                   | list out the various components of buildings.                                                                                                                                                                          |
| CO 3:                                                                   | sketch the various types of stairs and stair cases and their locations, sizes and materials including fire escapes and also lifts and escalators. Describe the various methods of shuttering, scaffolding and centring |
| CO 4:                                                                   | describe the various types expansion and construction joints and their construction.                                                                                                                                   |
| CO 5:                                                                   | Summarize the importance of construction planning.                                                                                                                                                                     |
| <b>Course Code: 19110305</b>                                            |                                                                                                                                                                                                                        |
| <b>Course Title: Surveying &amp; Geomatics</b>                          |                                                                                                                                                                                                                        |
| CO 1:                                                                   | Demonstrate the basic surveying skills                                                                                                                                                                                 |
| CO 2:                                                                   | Use various surveying instruments.                                                                                                                                                                                     |
| CO 3:                                                                   | Perform different methods of surveying                                                                                                                                                                                 |
| CO 4:                                                                   | Compute various data required for various methods of surveying.                                                                                                                                                        |
| CO 5:                                                                   | Develop the contour map                                                                                                                                                                                                |
| <b>Course Code: 19110306</b>                                            |                                                                                                                                                                                                                        |
| <b>Course Title: Fluid Mechanics</b>                                    |                                                                                                                                                                                                                        |
| CO 1:                                                                   | Define various properties of fluids, state and explain different types of laws and principles of fluid mechanics                                                                                                       |
| CO 2:                                                                   | Apply Principles of mathematics to represent kinematic concepts related to fluid flow                                                                                                                                  |
| CO 3:                                                                   | Derive Euler's Equation of motion and Deduce Bernoulli's equation                                                                                                                                                      |
| CO 4:                                                                   | Compute force of buoyancy on a partially or fully submerged body and analyse the stability of a floating body.                                                                                                         |
| CO 5:                                                                   | Measure velocity and rate of flow using various devices                                                                                                                                                                |
| <b>Course Code: 19110397</b>                                            |                                                                                                                                                                                                                        |
| <b>Course Title: Constitution of India</b>                              |                                                                                                                                                                                                                        |
| CO 1:                                                                   | List out the fundamental Rights and Duties                                                                                                                                                                             |
| CO 2:                                                                   | Explain the Union Government and Administrative system                                                                                                                                                                 |
| CO 3:                                                                   | Explain the State Government and Administrative system                                                                                                                                                                 |
| CO 4:                                                                   | Explain the Local Administrative system                                                                                                                                                                                |
| CO 5:                                                                   | Write the role of Election commission                                                                                                                                                                                  |
| <b>Course Code: 19110311</b>                                            |                                                                                                                                                                                                                        |
| <b>Course Title: Building planning and Drawing lab</b>                  |                                                                                                                                                                                                                        |
| CO 1:                                                                   | Create, display, and plot working drawings                                                                                                                                                                             |
| CO 2:                                                                   | Construct drawings using layer techniques                                                                                                                                                                              |
| CO 3:                                                                   | Construct technical drawings using a standard computer aided drafting program                                                                                                                                          |

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| CO 4:                                                         | evaluate modelling techniques such as edit, zoom, cross hatching, pattern filling, rotation, etc                                                         |
| CO 5:                                                         | Use the AutoCAD commands for drawing 2D building drawings required for different civil Engineering applications.                                         |
| <b>Course Code: 19110312</b>                                  |                                                                                                                                                          |
| <b>Course Title: Materials Testing Laboratory</b>             |                                                                                                                                                          |
| CO 1:                                                         | Determine the Engineering properties of materials in the laboratory.                                                                                     |
| CO 2:                                                         | Conduct laboratory tests to verify the suitability of the Engineering materials for the given purpose.                                                   |
| CO 3:                                                         | Verify the basic principles of behaviour of materials.                                                                                                   |
| CO 4:                                                         | Verify the quality of materials through laboratory tests.                                                                                                |
| CO 5:                                                         | Use various materials testing Equipment                                                                                                                  |
| <b>Course Code: 19110313</b>                                  |                                                                                                                                                          |
| <b>Course Title: Surveying Field Work</b>                     |                                                                                                                                                          |
| CO 1:                                                         | Apply the principle of surveying for civil Engineering Applications                                                                                      |
| CO 2:                                                         | Use techniques, skills and conventional surveying instruments necessary for engineering practice.                                                        |
| CO 3:                                                         | Make use of theodolite to find heights and distances as well as conducting trigonometric surveying                                                       |
| CO 4:                                                         | use the Equipment Total station and its applications                                                                                                     |
| CO 5:                                                         | Calculate the areas, drawing plans and contour maps using different measuring equipment at field level                                                   |
| <b>Course outcomes for Second Year Second Semester Course</b> |                                                                                                                                                          |
| <b>Course Code: 19110403</b>                                  |                                                                                                                                                          |
| <b>Course Title: Mechanics of materials</b>                   |                                                                                                                                                          |
| CO 1:                                                         | identify the basic concepts of Principal stresses, strains and various Theories of failures.                                                             |
| CO 2:                                                         | design the members for torsion, design the shafts and find the deflections of springs.                                                                   |
| CO 3:                                                         | find the stresses in columns and struts.                                                                                                                 |
| CO 4:                                                         | calculate the Stresses under the combined action of direct loading and B.M and determine the stresses in the case of chimneys, retaining walls and dams. |
| CO 5:                                                         | evaluate forces in different types of trusses used in construction.                                                                                      |
| <b>Course Code: 19110404</b>                                  |                                                                                                                                                          |
| <b>Course Title: Hydraulics and Hydraulic Machinery</b>       |                                                                                                                                                          |
| CO 1:                                                         | solve problems in uniform, gradually and rapidly varied flows in open channel in steadystate conditions.                                                 |
| CO 2:                                                         | Apply dimensional analysis and to differentiate the model, prototype and similitude conditions for practical problems.                                   |
| CO 3:                                                         | Calculate depth profiles in channels with steady gradually – varied flow.                                                                                |
| CO 4:                                                         | Write the working principles of various hydraulic machineries.                                                                                           |
| CO 5:                                                         | Evaluate the different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages     |
| <b>Course Code: 19110405</b>                                  |                                                                                                                                                          |
| <b>Course Title: Structural Analysis</b>                      |                                                                                                                                                          |
| CO 1:                                                         | Differentiate the determinate and indeterminate structures.                                                                                              |
| CO 2:                                                         | Identify the behaviour of structures due to the expected loads, including the moving loads, acting on the structure                                      |
| CO 3:                                                         | Estimate the bending moment and shear forces in beams for different boundary conditions.                                                                 |
| CO 4:                                                         | Analyse the continuous beams using various methods-, three moment method, slope deflection method, energy theorems.                                      |

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| CO 5:                                                                     | Draw the influence line diagrams for various types of moving loads on beams/bridges.                                                                    |
| <b>Course Code: 19110466A</b>                                             |                                                                                                                                                         |
| <b>Course Title: Construction Technology and Management</b>               |                                                                                                                                                         |
| CO 1:                                                                     | Evaluate the functioning of various earth moving equipment.                                                                                             |
| CO 2:                                                                     | Explain the methods of production of aggregate products and concreting.                                                                                 |
| CO 3:                                                                     | Apply the gained knowledge to project management and construction techniques.                                                                           |
| CO 4:                                                                     | Outline safety plans for demolition of buildings                                                                                                        |
| CO 5:                                                                     | Prepare fire safety plans for a given building                                                                                                          |
| <b>Course Code: 19110411</b>                                              |                                                                                                                                                         |
| <b>Course Title: Fluid Mechanics &amp; Hydraulic Machinery Laboratory</b> |                                                                                                                                                         |
| CO 1:                                                                     | Calibrate various discharge measurement meters in a open channel flow.                                                                                  |
| CO 2:                                                                     | Measure the discharge through an open channel.                                                                                                          |
| CO 3:                                                                     | Draw performance curves by conducting experiments on various hydraulic machineries.                                                                     |
| CO 4:                                                                     | Conduct efficiency and performance tests on turbines and pumps.                                                                                         |
| CO 5:                                                                     | Compare the results of analytical models introduced in lecture to the actual behaviour of real fluid flows and draw correct and sustainable conclusions |
| <b>Course Code: 19110412</b>                                              |                                                                                                                                                         |
| <b>Course Title: Environmental Engineering Laboratory</b>                 |                                                                                                                                                         |
| CO 1:                                                                     | Assess the quality of water and wastewater                                                                                                              |
| CO 2:                                                                     | Determine physical, chemical and biological characteristics of water and wastewater                                                                     |
| CO 3:                                                                     | Determine optimum dosage of coagulant                                                                                                                   |
| CO 4:                                                                     | Determine break - point chlorination                                                                                                                    |
| CO 5:                                                                     | Draw some conclusion and decide whether the water is potable or not.                                                                                    |
| <b>Course outcomes for Third Year First Semester Course</b>               |                                                                                                                                                         |
| <b>Course Code: 19110501</b>                                              |                                                                                                                                                         |
| <b>Course Title: Theory of Structures</b>                                 |                                                                                                                                                         |
| CO 1:                                                                     | Differentiate Determinate and Indeterminate Arch Structures                                                                                             |
| CO 2:                                                                     | Carryout lateral Load analysis of structures                                                                                                            |
| CO 3:                                                                     | Analyse Cable and Suspension Bridge structures                                                                                                          |
| CO 4:                                                                     | Analyse structures using Kani's Method                                                                                                                  |
| CO 5:                                                                     | Analyse structures using Matrix methods                                                                                                                 |
| <b>Course Code: 19110502</b>                                              |                                                                                                                                                         |
| <b>Course Title: Design of Reinforced Concrete Structures</b>             |                                                                                                                                                         |
| CO 1:                                                                     | Carryout analysis and design of flexural members and detailing                                                                                          |
| CO 2:                                                                     | Design structures subjected to shear, bond and torsion                                                                                                  |
| CO 3:                                                                     | Work on different types of design philosophies                                                                                                          |
| CO 4:                                                                     | Design different type of compression members                                                                                                            |
| CO 5:                                                                     | Design different type of Slabs and footings                                                                                                             |
| <b>Course Code: 19110503</b>                                              |                                                                                                                                                         |
| <b>Course Title: Soil Mechanics</b>                                       |                                                                                                                                                         |
| CO 1:                                                                     | To define various quantities related to soil mechanics and establish their inter-relationships. To                                                      |

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|                                                                | determine various index properties of the soils and classify the soils                                                                                                                                                                    |
| CO 2:                                                          | To list down the importance of different engineering properties of the soil such as compaction, permeability                                                                                                                              |
| CO 3:                                                          | To calculate Stress Distribution In Soils                                                                                                                                                                                                 |
| CO 4:                                                          | To list down the importance of consolidation and determine it                                                                                                                                                                             |
| CO 5:                                                          | To list down the importance of shear strength and determine it                                                                                                                                                                            |
| <b>Course Code: 19110504</b>                                   |                                                                                                                                                                                                                                           |
| <b>Course Title: Engineering Geology</b>                       |                                                                                                                                                                                                                                           |
| CO 1:                                                          | Identify and classify the geological minerals                                                                                                                                                                                             |
| CO 2:                                                          | To Measure the rock strengths of various rocks                                                                                                                                                                                            |
| CO 3:                                                          | Classify and measure the earthquake prone areas to practice the hazard zonation                                                                                                                                                           |
| CO 4:                                                          | Investigate the ground conditions through geophysical surveys                                                                                                                                                                             |
| CO 5:                                                          | Investigate the project site for mega/mini civil engineering projects. Site selection for mega engineering projects like Dams, Tunnels, disposal sites etc...                                                                             |
| <b>Course Code: 19110505</b>                                   |                                                                                                                                                                                                                                           |
| <b>Course Title: Hydrology Engineering</b>                     |                                                                                                                                                                                                                                           |
| CO 1:                                                          | To Have a thorough understanding of the theories and principles governing the hydrologic processes and measuring precipitation also to Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures |
| CO 2:                                                          | Estimate average rainfall, direct run off from total rain fall, groundwater flow and flood discharge in the catchment area                                                                                                                |
| CO 3:                                                          | Develop Hydrograph for a given catchment                                                                                                                                                                                                  |
| CO 4:                                                          | Estimate average rainfall, direct run off from total rain fall, groundwater flow and flood discharge in the catchment area                                                                                                                |
| CO 5:                                                          | Examine the aquifer properties and assess the yield of the aquifer                                                                                                                                                                        |
| <b>Course Code: 19110566A</b>                                  |                                                                                                                                                                                                                                           |
| <b>Course Title: Repair &amp; Rehabilitation of Structures</b> |                                                                                                                                                                                                                                           |
| CO 1:                                                          | Explain deterioration of concrete in structures                                                                                                                                                                                           |
| CO 2:                                                          | Carryout analysis using NDT and evaluate structures                                                                                                                                                                                       |
| CO 3:                                                          | Assess failures and causes of failures in structures                                                                                                                                                                                      |
| CO 4:                                                          | Carryout Physical evaluation and submit report on condition of the structure                                                                                                                                                              |
| CO 5:                                                          | Carry out Repair Techniques                                                                                                                                                                                                               |
| <b>Course Code: 19110566B</b>                                  |                                                                                                                                                                                                                                           |
| <b>Course Title: Expansive Soils</b>                           |                                                                                                                                                                                                                                           |
| CO 1:                                                          | Understand the behaviour of expansive soils                                                                                                                                                                                               |
| CO 2:                                                          | Assess the foundation practices on expansive soils                                                                                                                                                                                        |
| CO 3:                                                          | Perform the methods of stabilization expansive soils                                                                                                                                                                                      |
| CO 4:                                                          | Select additives and the methodology for stabilization                                                                                                                                                                                    |
| CO 5:                                                          | Apply the gained knowledge for suitable performance                                                                                                                                                                                       |
| <b>Course Code: 19110566C</b>                                  |                                                                                                                                                                                                                                           |
| <b>Course Title: Airports, Docks and Harbour Engineering</b>   |                                                                                                                                                                                                                                           |
| CO 1:                                                          | Plan an airport                                                                                                                                                                                                                           |
| CO 2:                                                          | Design the Runway                                                                                                                                                                                                                         |
| CO 3:                                                          | Design the Airport Drainage                                                                                                                                                                                                               |

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| CO 4:                                                        | Plan Ports and Docks                                                                                                                                                                                                 |
| CO 5:                                                        | Plan Harbours                                                                                                                                                                                                        |
| <b>Course Code: 19110566D</b>                                |                                                                                                                                                                                                                      |
| <b>Course Title: Environmental Impact Assessment</b>         |                                                                                                                                                                                                                      |
| CO 1:                                                        | Prepare EMP, EIS, and EIA report                                                                                                                                                                                     |
| CO 2:                                                        | Identify the risks and impacts of a project                                                                                                                                                                          |
| CO 3:                                                        | Select an appropriate EIA methodology                                                                                                                                                                                |
| CO 4:                                                        | Evaluate the EIA report                                                                                                                                                                                              |
| CO 5:                                                        | Know the role of stakeholder and public hearing in the preparation of EIA                                                                                                                                            |
| <b>Course Code: 19110511</b>                                 |                                                                                                                                                                                                                      |
| <b>Course Title: Soil Mechanics Laboratory</b>               |                                                                                                                                                                                                                      |
| CO 1:                                                        | Determine index properties of soil and classify them                                                                                                                                                                 |
| CO 2:                                                        | Determine permeability of soils                                                                                                                                                                                      |
| CO 3:                                                        | Determine Consolidation                                                                                                                                                                                              |
| CO 4:                                                        | Determine Compaction                                                                                                                                                                                                 |
| CO 5:                                                        | Determine shear strength characteristics                                                                                                                                                                             |
| <b>Course Code: 19110512</b>                                 |                                                                                                                                                                                                                      |
| <b>Course Title: Engineering Geology Lab</b>                 |                                                                                                                                                                                                                      |
| CO 1:                                                        | Identify Mega-scope minerals & their properties.                                                                                                                                                                     |
| CO 2:                                                        | Identify Mega-scope rocks & their properties                                                                                                                                                                         |
| CO 3:                                                        | Identify the site parameters such as contour, slope & aspect for topography                                                                                                                                          |
| CO 4:                                                        | Know the occurrence of materials using the strike & dip problems                                                                                                                                                     |
| CO 5:                                                        | Know engineering geology in detail                                                                                                                                                                                   |
| <b>Course Code: 19110513</b>                                 |                                                                                                                                                                                                                      |
| <b>Course Title: Mini Project-1/Study Project/Internship</b> |                                                                                                                                                                                                                      |
| CO 1:                                                        | Student is able to construct the company profile by compiling the brief history, management structure, products / services offered, key achievements and market performance for his / her organization of internship |
| CO 2:                                                        | For his / her organization of internship, the student is able to assess its Strengths, Weaknesses, Opportunities and Threats (SWOT).                                                                                 |
| CO 3:                                                        | Student is able to determine the challenges and future potential for his / her internship organization in particular and the sector in general                                                                       |
| CO 4:                                                        | Student is able to test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period                                                                            |
| CO 5:                                                        | Student is able to apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization                                 |
| CO 6:                                                        | Student is able to analyse the functioning of internship organization and recommend changes for improvement in processes                                                                                             |
| <b>Course outcomes for Third Year Second Semester Course</b> |                                                                                                                                                                                                                      |
| <b>Course Code: 19110661E</b>                                |                                                                                                                                                                                                                      |
| <b>Course Title: Solid Waste Management</b>                  |                                                                                                                                                                                                                      |
| CO 1:                                                        | Understand the Objects of Solid waste management                                                                                                                                                                     |
| CO 2:                                                        | Understand the elements of Solid waste management                                                                                                                                                                    |
| CO 3:                                                        | Design the Transportation facility in Solid waste management                                                                                                                                                         |

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|                                                 |                                                                                                                           |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| CO 4:                                           | Characterise the solid waste and design a composting facility                                                             |
| CO 5:                                           | Know the criteria for selection of landfill                                                                               |
| <b>Course Code: 19110602</b>                    |                                                                                                                           |
| <b>Course Title: Design of Steel Structures</b> |                                                                                                                           |
| CO 1:                                           | Work with relevant IS codes                                                                                               |
| CO 2:                                           | Carryout analysis and design of flexural members and detailing                                                            |
| CO 3:                                           | Design compression members of different types with connection detailing                                                   |
| CO 4:                                           | Design Plate Girder with connection detailing                                                                             |
| CO 5:                                           | Produce the drawings pertaining to different components of steel structures                                               |
| <b>Course Code: 19110603</b>                    |                                                                                                                           |
| <b>Course Title: Foundation Engineering</b>     |                                                                                                                           |
| CO 1:                                           | Understand the various types of shallow foundations and decide on their location based on soil characteristics            |
| CO 2:                                           | Compute the magnitude of foundation settlement                                                                            |
| CO 3:                                           | Use the field test data and arrive at the bearing capacity                                                                |
| CO 4:                                           | Apply the principles of bearing capacity of piles and design them accordingly.                                            |
| CO 5:                                           | To decide the size of the foundation                                                                                      |
| <b>Course Code: 19110604</b>                    |                                                                                                                           |
| <b>Course Title: Transportation Engineering</b> |                                                                                                                           |
| CO 1:                                           | Plan highway network for a given area. Determine Highway alignment and design highway geometrics                          |
| CO 2:                                           | Judge suitability of pavement materials and design flexible and rigid pavements. Construct highways                       |
| CO 3:                                           | Design geometrics in a railway track                                                                                      |
| CO 4:                                           | Design airport geometrics and airfield pavements                                                                          |
| CO 5:                                           | Plan, construct and maintain Docks and Harbours                                                                           |
| <b>Course Code: 19110605</b>                    |                                                                                                                           |
| <b>Course Title: Irrigation Engineering</b>     |                                                                                                                           |
| CO 1:                                           | Estimate irrigation water requirements                                                                                    |
| CO 2:                                           | Design and Plan irrigation canals and canal network                                                                       |
| CO 3:                                           | Design irrigation canal structures                                                                                        |
| CO 4:                                           | Plan and design diversion head works                                                                                      |
| CO 5:                                           | Analyse stability of gravity and earth dams and Design ogee spillways and energy dissipation works                        |
| <b>Course Code: 19110606</b>                    |                                                                                                                           |
| <b>Course Title: Concrete Technology</b>        |                                                                                                                           |
| CO 1:                                           | Understand the basic concepts of concrete                                                                                 |
| CO 2:                                           | Realise the importance of quality of concrete                                                                             |
| CO 3:                                           | Familiarise the basic ingredients of concrete and their role in the production of concrete and its behaviour in the field |
| CO 4:                                           | Test the fresh concrete properties and the hardened concrete properties                                                   |
| CO 5:                                           | Evaluate the ingredients of concrete through lab test results                                                             |

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**Course Code: 19110611**

**Course Title: Software applications in Civil Engineering**

|       |                                                                         |
|-------|-------------------------------------------------------------------------|
| CO 1: | Work comfortably on GIS software                                        |
| CO 2: | Digitize and create thematic map and extract important features         |
| CO 3: | Develop digital elevation model                                         |
| CO 4: | Use structural analysis software to analyse and design 2D and 3D frames |
| CO 5: | Design and analyse retaining wall and simple towers using CADD software |

**Course Code: 19110612**

**Course Title: Concrete Technology & Transportation Engineering Laboratory**

|       |                                                                                                 |
|-------|-------------------------------------------------------------------------------------------------|
| CO 1: | Determine the consistency and fineness of cement                                                |
| CO 2: | Determine the setting times of cement                                                           |
| CO 3: | Determine the specific gravity and soundness of cement                                          |
| CO 4: | Determine the compressive strength of cement                                                    |
| CO 5: | Ability to test aggregates and judge the suitability of materials for the road construction     |
| CO 6: | Ability to test the given bitumen samples and judge their suitability for the road construction |

**Course outcomes for Fourth Year First Semester Course**

**Course Code: 19116761E**

**Course Title: Global Environment: Problems & Policies**

|       |                                                                                                                                            |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------|
| CO 1: | To Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving       |
| CO 2: | To Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world  |
| CO 3: | To Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems  |
| CO 4: | To know environmental laws and grasp the concept of environmental legislation and its application in international environmental agreement |
| CO 5: | To appreciate the concern of environmental agreement                                                                                       |

**Course Code: 19110703**

**Course Title: Pre stressed Concrete**

|       |                                                                            |
|-------|----------------------------------------------------------------------------|
| CO 1: | Understand the different methods of pre stressing                          |
| CO 2: | Estimate the effective prestress including the short- and long-term losses |
| CO 3: | Analyse and design prestressed concrete beams under flexure and shear      |
| CO 4: | Understand the relevant IS Code provisions for prestressed concrete        |
| CO 5: | Understand the Anchorage zone stresses                                     |

**Course Code: 19110764-A**

**Course Title: Advanced Structural Engineering**

|       |                                                                     |
|-------|---------------------------------------------------------------------|
| CO 1: | Design raft foundations and different types of RCC retaining walls  |
| CO 2: | Carryout analysis and design of different types of RCC water tanks  |
| CO 3: | Design of Flat slabs and grid floors                                |
| CO 4: | Perform analysis and Design of chimneys                             |
| CO 5: | Understand various types of transmission towers and loading on them |

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| <b>Course Code: 19110764-B</b>                       |                                                                                                                                                                                                             |
| <b>Course Title: Ground Improvement Techniques</b>   |                                                                                                                                                                                                             |
| CO 1:                                                | Understand various methods of ground improvement and their suitability to different field situations                                                                                                        |
| CO 2:                                                | Design a reinforced earth embankment and check its stability                                                                                                                                                |
| CO 3:                                                | Know the various functions of Geo synthetics and their applications in Civil Engineering practice                                                                                                           |
| CO 4:                                                | Understand the concepts and applications of grouting                                                                                                                                                        |
| CO 5:                                                | Understand the Reinforced earth technology and soil nailing                                                                                                                                                 |
| <b>Course Code: 19110764-C</b>                       |                                                                                                                                                                                                             |
| <b>Course Title: Traffic Engineering</b>             |                                                                                                                                                                                                             |
| CO 1:                                                | Determine traffic speed, volume, travel time and density                                                                                                                                                    |
| CO 2:                                                | Design traffic signals                                                                                                                                                                                      |
| CO 3:                                                | Determine highway capacity                                                                                                                                                                                  |
| CO 4:                                                | To provide knowledge of traffic control devices and its techniques in transportation interaction.                                                                                                           |
| CO 5:                                                | To develop a strong knowledge base of traffic planning and its management in any transportation area                                                                                                        |
| <b>Course Code: 19110764-D</b>                       |                                                                                                                                                                                                             |
| <b>Course Title: Watershed Management</b>            |                                                                                                                                                                                                             |
| CO 1:                                                | Calculate watershed parameters                                                                                                                                                                              |
| CO 2:                                                | Analyse watershed characteristics to take appropriate management action                                                                                                                                     |
| CO 3:                                                | Quantify soil erosion and design control measures                                                                                                                                                           |
| CO 4:                                                | Suggest suitable harvesting techniques for better watershed management                                                                                                                                      |
| CO 5:                                                | Apply appropriate models for watershed management                                                                                                                                                           |
| <b>Course Code: 19110765-A</b>                       |                                                                                                                                                                                                             |
| <b>Course Title: Matrix Analysis of Structures</b>   |                                                                                                                                                                                                             |
| CO 1:                                                | Analyse the in determinant beams and frames by Stiffness method                                                                                                                                             |
| CO 2:                                                | Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent deformations, force and equilibrium methods                 |
| CO 3:                                                | Perform structural analysis using the stiffness method                                                                                                                                                      |
| CO 4:                                                | Solve multiple degree of freedom two dimensional problems involving trusses, beams, frames and plane stress                                                                                                 |
| CO 5:                                                | Evaluate determinate and indeterminate trusses and its application in the field                                                                                                                             |
| <b>Course Code: 19110765-B</b>                       |                                                                                                                                                                                                             |
| <b>Course Title: Advanced Foundation Engineering</b> |                                                                                                                                                                                                             |
| CO 1:                                                | Determine the bearing capacity of shallow foundations for different loading and ground conditions using different methods                                                                                   |
| CO 2:                                                | Know the choice and type of shallow foundation and the design considerations and its design                                                                                                                 |
| CO 3:                                                | Determine the allowable bearing capacity                                                                                                                                                                    |
| CO 4:                                                | Understand classification of piles and determine the load carrying capacity of piles by end bearing methods and the pull- out capacity of piles and down drag forces on piles due to negative skin friction |
| CO 5:                                                | Determine the load carrying capacity of pile groups and the load carrying capacity of laterally loaded piles                                                                                                |

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| <b>Course Code: 19110765-C</b>                                        |                                                                                                                        |
| <b>Course Title: Urban Transportation Planning</b>                    |                                                                                                                        |
| CO 1:                                                                 | To Create Knowledge on Origin and Destination Surveys and Analysis of survey data                                      |
| CO 2:                                                                 | To develop abilities required for Transport planning                                                                   |
| CO 3:                                                                 | To have knowledge on requirement of four stages of transportation planning                                             |
| CO 4:                                                                 | To Model the land utilization for urban transport planning                                                             |
| CO 5:                                                                 | To Interpret the Traffic and Transportation Problems in Indian towns/cities                                            |
| <b>Course Code: 19110765-D</b>                                        |                                                                                                                        |
| <b>Course Title: Remote Sensing and GIS</b>                           |                                                                                                                        |
| CO 1:                                                                 | understand ground, air and satellite-based sensor platforms                                                            |
| CO 2:                                                                 | Interpret the aerial photographs                                                                                       |
| CO 3:                                                                 | Create and input spatial data for GIS application                                                                      |
| CO 4:                                                                 | Apply RS and GIS concepts in water resources engineering                                                               |
| CO 5:                                                                 | Interpret the satellite imageries                                                                                      |
| <b>Course Code: 19110711</b>                                          |                                                                                                                        |
| <b>Course Title: Infrastructure Design and Detailing Laboratory</b>   |                                                                                                                        |
| CO 1:                                                                 | Design the Beams                                                                                                       |
| CO 2:                                                                 | Design the columns                                                                                                     |
| CO 3:                                                                 | Design the Slabs                                                                                                       |
| CO 4:                                                                 | Design the Water Tank                                                                                                  |
| CO 5:                                                                 | Design the Retaining Wall                                                                                              |
| <b>Course Code: 19110731-19110721</b>                                 |                                                                                                                        |
| <b>Course Title: Summer Internship/ Mini Project -2</b>               |                                                                                                                        |
| CO 1:                                                                 | Acquire on job the skills, knowledge, and attitude, which are requisite to constitute a professional identity          |
| CO 2:                                                                 | Demonstrate professional values and ethical standards                                                                  |
| CO 3:                                                                 | Ability to handle real life challenges by making effective decisions at the organisations                              |
| CO 4:                                                                 | Adapt effectively to changing conditions                                                                               |
| <b>Course outcomes for Fourth Year Second Semester Course</b>         |                                                                                                                        |
| <b>Course Code: 191100801</b>                                         |                                                                                                                        |
| <b>Course Title: Estimating, Specifications &amp; Contracts</b>       |                                                                                                                        |
| CO 1:                                                                 | Determine the quantities of different components of buildings                                                          |
| CO 2:                                                                 | Find the cost of various building components                                                                           |
| CO 3:                                                                 | Capable of finalizing the value of structures                                                                          |
| CO 4:                                                                 | Prepare and evaluate contract documents                                                                                |
| CO 5:                                                                 | Impart the knowledge of Estimating, Costing and Valuation for Civil Engineering Structures                             |
| <b>Course Code: 19110862-D</b>                                        |                                                                                                                        |
| <b>Course Title: Industrial Waste &amp; Waste - Water Engineering</b> |                                                                                                                        |
| CO 1:                                                                 | Suggest treatment methods for any industrial wastewater                                                                |
| CO 2:                                                                 | Learn the manufacturing process of various industries                                                                  |
| CO 3:                                                                 | Student will be in a position to decide the need of effluent treatment plant for the industrial area in their vicinity |

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|------------------------------|-------------------------------------------------------------------------------|
| CO 4:                        | Identify and design treatment options for industrial wastewater               |
| CO 5:                        | Formulate environmental management plan                                       |
| <b>Course Code: 19110841</b> |                                                                               |
| <b>Course Title: Project</b> |                                                                               |
| CO 1:                        | Apply all levels of Engineering knowledge in solving the Engineering problems |
| CO 2:                        | Work together with team spirit                                                |
| CO 3:                        | Use Civil Engineering software at least one                                   |
| CO 4:                        | Document the projects                                                         |

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## GRBT-19 B.Tech (Electrical & Electronic Engineering)

### Department Vision:

To be a pioneering department in preparing students to compete globally in their profession and making significant contribution to the society.

### Department Mission:

- Establishing centers of excellence with focus on advanced technology
- By preparing the students for successful careers based on a strong moral and ethical foundation
- Delivering world class teaching, mentoring, intellectual stimulation, industry collaborations and state of the art research
- By training and educating students as global citizens to become entrepreneurs in their chosen field

### Program Educational Objectives (PEOs):

|             |                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PEO1</b> | Engage in ongoing learning and professional development through self-study, continuing education in Electrical and Electronics Engineering and also in other allied fields        |
| <b>PEO2</b> | Apply their engineering skills, exhibiting critical thinking and problem solving skills in professional engineering practices or tackle social, technical and business challenges |
| <b>PEO3</b> | Improve professional competence through lifelong learning including higher education and research                                                                                 |

### Program Specific Outcomes (PSO's):

|             |                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b> | Apply knowledge of power system configuration, electrical equipment and protection practices to the design and specifications of electrical generation, transmission, distribution and utilization systems |
| <b>PSO2</b> | To design, analyze, test and evaluate the performance of the electrical machines and transformers                                                                                                          |
| <b>PSO3</b> | To develop the expertise in the technology associated with efficient conversion and control of electrical power by static means from available forms to the required form                                  |
| <b>PSO4</b> | Graduates will be able to work as research fellow and implement their knowledge in all electrical and electronics research organization of defense, renewable energy, mines, chemical and power plants     |

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**Program Outcomes (POs): Engineering Graduates will be able to:**

|    |                                                                                                                                                                                                                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | <b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.                                                                                                                  |
| 2  | <b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.                                                                 |
| 3  | <b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.         |
| 4  | <b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.                                                                |
| 5  | <b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.                                                                 |
| 6  | <b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.                                                               |
| 7  | <b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.                                                                                   |
| 8  | <b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.                                                                                                                                                                    |
| 9  | <b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.                                                                                                                                                   |
| 10 | <b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| 11 | <b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.                                              |
| 12 | <b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.                                                                                                                 |

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| Course Outcomes for First Year First Semester Course        |                                                                                                                                                               |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Code: 19199101</b>                                |                                                                                                                                                               |
| <b>Course Title: Mathematics-I</b>                          |                                                                                                                                                               |
| CO-1                                                        | Transform the knowledge of solving system of linear equations using matrices                                                                                  |
| CO-2                                                        | Evaluate the nature of the quadratic form                                                                                                                     |
| CO-3                                                        | Acquire the knowledge of maxima and minima of function of several v variables                                                                                 |
| CO-4                                                        | Evaluate multiple integrals and their applications                                                                                                            |
| <b>Course Code: 19199102</b>                                |                                                                                                                                                               |
| <b>Course Title: Communicative English-I</b>                |                                                                                                                                                               |
| CO-1                                                        | Develop effective reading strategies                                                                                                                          |
| CO-2                                                        | Demonstrate writing skills that are required for professional development and use graphic elements for communication                                          |
| CO-3                                                        | Apply grammatical skills and vocabulary effectively in speech and writing                                                                                     |
| CO-4                                                        | Display language efficacy in tune with subjective knowledge                                                                                                   |
| <b>Course Code: 19192106</b>                                |                                                                                                                                                               |
| <b>Course Title: Engineering Electro magnetic</b>           |                                                                                                                                                               |
| CO-1                                                        | Analyze field potentials due to static changes and static magnetic fields                                                                                     |
| CO-2                                                        | Explain how materials affect electric and magnetic fields                                                                                                     |
| CO-3                                                        | Analyze the relation between the fields under time varying situations.                                                                                        |
| CO-4                                                        | Discuss the principles of propagation of uniform plane waves.                                                                                                 |
| CO-5                                                        | Justify the concepts of electromagnetic waves, mean of transporting energy or information. in the form of radio waves, TV signals, radar beams and light rays |
| <b>Course Code: 19199103</b>                                |                                                                                                                                                               |
| <b>Course Title: Applied Chemistry</b>                      |                                                                                                                                                               |
| CO-1                                                        | Understand the removal technique of hardness of the water                                                                                                     |
| CO-2                                                        | Distinguish the fuel cells and batteries                                                                                                                      |
| CO-3                                                        | Identify different control techniques of corrosion                                                                                                            |
| CO-4                                                        | Understand the concept of plastics and rubbers                                                                                                                |
| <b>Course Code: 19195105</b>                                |                                                                                                                                                               |
| <b>Course Title: Problem Solving &amp; Programming in C</b> |                                                                                                                                                               |
| CO-1                                                        | Obtain the knowledge about different languages used in computer programming                                                                                   |
| CO-2                                                        | Write algorithm. Flow chart, and structure of C program and make use of different C tokens                                                                    |
| CO-3                                                        | Develop program by using control structure , different looping and Jump statements                                                                            |
| CO-4                                                        | Implement applications of Array, structure and String inside the program                                                                                      |
| <b>Course Code: 19199194</b>                                |                                                                                                                                                               |
| <b>Course Title: Professional Ethics &amp; Human Values</b> |                                                                                                                                                               |
| CO-1                                                        | By the end of the course student should be able to understand the importance of ethics and values in life and society                                         |

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| <b>Course Code: 19199114</b>                                             |                                                                                                    |
| <b>Course Title: Engineering Chemistry Laboratory</b>                    |                                                                                                    |
| CO-1                                                                     | Explain the functioning of the instruments such as pH, Conductivity and Potentiometric meters      |
| CO-2                                                                     | Determine the total hardness of the water                                                          |
| CO-3                                                                     | Perform various Redox titrations                                                                   |
| CO-4                                                                     | Preparation of polymers                                                                            |
| <b>Course Code: 19193112</b>                                             |                                                                                                    |
| <b>Course Title: Basic Engineering Workshop</b>                          |                                                                                                    |
| CO-1                                                                     | Explain the limitations, tolerances, safety aspects of electrical systems & wiring.                |
| CO-2                                                                     | Select wires/cables and other accessories used in different types of wiring                        |
| CO-3                                                                     | Make simple lighting and power circuits                                                            |
| CO-4                                                                     | Make disassembling and assembling of PC.                                                           |
| <b>Course Code: 19199111</b>                                             |                                                                                                    |
| <b>Course Title: Communicative English Laboratory</b>                    |                                                                                                    |
| CO-1                                                                     | Learn to communicate in English                                                                    |
| CO-2                                                                     | Comprehend native speaker's accent                                                                 |
| CO-3                                                                     | Speak appropriately in real life situations                                                        |
| CO-4                                                                     | Display public speaking skills in the required context                                             |
| <b>Course Code: 19195113</b>                                             |                                                                                                    |
| <b>Course Title: Problem Solving &amp; Programming Laboratory with C</b> |                                                                                                    |
| CO-1                                                                     | Obtain the knowledge about different languages used in computer programming                        |
| CO-2                                                                     | Write algorithm. Flow chart, and structure of C program and make use of different C tokens         |
| CO-3                                                                     | Develop program by using control structure, different looping and Jump statements                  |
| CO-4                                                                     | Implement applications of Array, structure and String inside the program                           |
| <b>Course Outcomes for First Year Second Semester Course</b>             |                                                                                                    |
| <b>Course Code: 19199201a</b>                                            |                                                                                                    |
| <b>Course Title: Mathematics-II</b>                                      |                                                                                                    |
| CO-1                                                                     | Solve first order differential equations                                                           |
| CO-2                                                                     | Solve higher order differential equations with constant coefficients                               |
| CO-3                                                                     | Understand numerical differentiation and integration                                               |
| <b>Course Code: 19199204</b>                                             |                                                                                                    |
| <b>Course Title: Engineering Physics</b>                                 |                                                                                                    |
| CO-1                                                                     | To impart knowledge of physical optical phenomenon like interference, diffraction and polarization |
| CO-2                                                                     | To demonstrate the concept of absorption and emission                                              |
| CO-3                                                                     | To study the Schrodinger equation for standard systems by analytical and numerical methods         |

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| CO-4                                                | To classify the energy bands of semiconductors                                                                                           |
| <b>Course Code: 19199202</b>                        |                                                                                                                                          |
| <b>Course Title: Communicative English-II</b>       |                                                                                                                                          |
| CO-1                                                | Develop effective reading strategies                                                                                                     |
| CO-2                                                | Demonstrate writing skills that are required for professional development and use graphic elements for communication                     |
| CO-3                                                | Apply grammatical skills and vocabulary effectively in speech and writing                                                                |
| CO-4                                                | Display language efficacy in tune with subjective knowledge                                                                              |
| CO-5                                                | Use required language along with contextual vocabulary and grammar structures                                                            |
| <b>Course Code: 19199296a</b>                       |                                                                                                                                          |
| <b>Course Title: Environmental Science</b>          |                                                                                                                                          |
| CO-1                                                | Gain a higher level of personal involvement and interest in understanding and solving environmental problems                             |
| CO-2                                                | Comprehend environmental problems from multiple perspectives with emphasis on human modern life styles and developmental activities      |
| CO-3                                                | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of 21 <sup>st</sup> century |
| CO-4                                                | Recognize the interconnectedness of human dependence on the earth's eco system                                                           |
| <b>Course Code: 19192203</b>                        |                                                                                                                                          |
| <b>Course Title: Electrical circuit analysis-I</b>  |                                                                                                                                          |
| CO-1                                                | Analyze electrical network in presence of active and passive elements                                                                    |
| CO-2                                                | Analyze magnetic circuit with various dot convention                                                                                     |
| CO-3                                                | Analyze steady state circuits                                                                                                            |
| CO-4                                                | Analyze series and parallel resonant circuit                                                                                             |
| CO-5                                                | Analyze electric circuits using Network Theorems                                                                                         |
| <b>Course Code: 19193275</b>                        |                                                                                                                                          |
| <b>Course Title: Engineering Graphics</b>           |                                                                                                                                          |
| CO-1                                                | Apply principles of drawing to represent dimensions of an object                                                                         |
| CO-2                                                | Outline the Polygons and engineering curves                                                                                              |
| CO-3                                                | Illustrate projections of points, lines, plane and solids                                                                                |
| CO-4                                                | Illustrate 3D views through isometric views                                                                                              |
| <b>Course code : 19199212</b>                       |                                                                                                                                          |
| <b>Course Title: Engineering Physics Laboratory</b> |                                                                                                                                          |
| CO-1                                                | To handle optical instruments like microscope and spectrometer                                                                           |
| CO-2                                                | To demonstrate the importance of dielectric material in storage of electric field energy in capacitors                                   |

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| CO-3                                                     | To evaluate the resistivity of the given semiconductor using probe method           |
| CO-4                                                     | To identify the type of semi-conductor                                              |
| <b>Course Code: 19199211</b>                             |                                                                                     |
| <b>Course Title: Communicative English Laboratory II</b> |                                                                                     |
| CO-1                                                     | Learn to communicate in English                                                     |
| CO-2                                                     | Comprehend native speaker's accent                                                  |
| CO-3                                                     | Speak appropriately in real life situations                                         |
| CO-4                                                     | Display public speaking skills in the required context                              |
| <b>Course code : 19192213</b>                            |                                                                                     |
| <b>Course Title: Electrical Engineering workshop</b>     |                                                                                     |
| CO-1                                                     | Explain the limitations, tolerances, safety aspects of electrical systems & wiring. |
| CO-2                                                     | Select wires/cables and other accessories used in different types of wiring.        |
| CO-3                                                     | Make simple lighting and power circuits.                                            |
| CO-4                                                     | Measure current, voltage and power in a circuit.                                    |
| CO-5                                                     | Make disassembling and assembling of PC                                             |

| <b>Course Outcomes for Second Year First Semester Course</b>    |                                                                                                                                          |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Code: 19120301</b>                                    |                                                                                                                                          |
| <b>Course Title: Complex variables and Transform Techniques</b> |                                                                                                                                          |
| CO-1                                                            | Familiarize with the techniques in partial differential equations and complex variables                                                  |
| CO-2                                                            | Solve application problems                                                                                                               |
| CO-3                                                            | Familiarize the transform techniques and complex variables                                                                               |
| <b>Course Code: 19120302</b>                                    |                                                                                                                                          |
| <b>Course Title: Electrical Circuits Analysis-II</b>            |                                                                                                                                          |
| CO-1                                                            | Able to solve three- phase circuits under balanced and unbalanced condition                                                              |
| CO-2                                                            | Learn transient response of electrical networks for different types of excitations.                                                      |
| CO-3                                                            | To find parameters for different types of network.                                                                                       |
| CO-4                                                            | To realize electrical equivalent network for a given network transfer function.                                                          |
| CO-5                                                            | To extract different harmonics components from the response of a electrical network..                                                    |
| <b>Course Code: 19120303</b>                                    |                                                                                                                                          |
| <b>Course Title: Electrical Machines – I</b>                    |                                                                                                                                          |
| CO-1                                                            | Analyze the conditions required of self excitation of dc generators and parallel operation of dc generators the operation of dc machines |
| CO-2                                                            | Determine the performance of dc machine using the results of tests                                                                       |
| CO-3                                                            | Distinguish the operation of various dc machine configurations.                                                                          |
| CO-4                                                            | Determine the voltage regulation and efficiency of single phase transformer                                                              |
| CO-5                                                            | Analyze poly phase transformers connections                                                                                              |

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**Course Code: 19120304**

**Course Title: Electronic Devices & Circuits**

|      |                                                                                                                                           |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the basic concepts of semiconductor physics                                                                                    |
| CO-2 | Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation                |
| CO-3 | Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons       |
| CO-4 | Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configuration |
| CO-5 | Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions     |

**Course Code: 19120305**

**Course Title: Electrical Measurements**

|      |                                                                                                                                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Know principles of different electrical measurement instruments and to measure voltage and current and different types of instruments for measurement of Power and Energy. |
| CO-2 | Understand about different types of A.C and D. C Potentiometers                                                                                                            |
| CO-3 | Measure resistance, capacitance, inductance and frequency by using various bridges                                                                                         |
| CO-4 | Know about the magnetic measurements                                                                                                                                       |
| CO-5 | Understand about digital measurements                                                                                                                                      |

**Course Code: 19120312**

**Course Title: Electrical Circuits Lab**

|      |                                                                           |
|------|---------------------------------------------------------------------------|
| CO-1 | Apply mesh and nodal analysis to solve electrical circuit problems        |
| CO-2 | Analyze circuits in the sinusoidal steady-state domain                    |
| CO-3 | Apply network theorems for the analysis of circuits and two port networks |
| CO-4 | Measure active and reactive powers                                        |
| CO-5 | Measure Network parameters                                                |

**Course Code: 19120313**

**Course Title: Electrical Machines –I Lab**

|      |                                                  |
|------|--------------------------------------------------|
| CO-1 | Determine the performance of DC shunt machine    |
| CO-2 | Determine the performance of DC series machine   |
| CO-3 | Determine the performance of DC compound machine |
| CO-4 | Connect DC machines in parallel                  |
| CO-5 | Control speed of DC machine                      |

**Course Code: 19120314**

**Course Title: Electrical Measurements Lab**

|      |                                                                              |
|------|------------------------------------------------------------------------------|
| CO-1 | Measure accurately the electrical parameters voltage, current, power, energy |
| CO-2 | Electrical characteristics of resistance, inductance and capacitance.        |
| CO-3 | Measure illumination of electrical lamps.                                    |
| CO-4 | Test transformer oil for its effectiveness.                                  |
| CO-5 | Measure the parameters of inductive coil in a 1- $\emptyset$ transformer.    |

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**Course Code: 19124311**

**Course Title: Electronic Devices & Circuits Lab**

|      |                                                                                       |
|------|---------------------------------------------------------------------------------------|
| CO-1 | Analyze the characteristics of diodes, transistors and other devices                  |
| CO-2 | Design and implement the rectifier circuits, SCR and UJT in the hardware circuits     |
| CO-3 | Design the biasing and amplifiers of BJT and FET amplifiers                           |
| CO-4 | Measure electrical quantities using CRO in the experimentation                        |
| CO-5 | Understand the frequency response of amplifiers, measure frequency, phase of signals. |

**Course Outcomes for Second Year Second Semester Course**

**Course Code: 19129401**

**Course Title: Numerical Methods and Probability & Statistics**

|      |                                                                                         |
|------|-----------------------------------------------------------------------------------------|
| CO-1 | Familiarize with the techniques in partial differential equations and complex variables |
| CO-2 | Solve application problems                                                              |
| CO-3 | Familiarize the transform techniques and complex variables                              |

**Course Code: 19120405**

**Course Title: Power systems -I**

|      |                                                                                                     |
|------|-----------------------------------------------------------------------------------------------------|
| CO-1 | Understand the Principle of operation of different types of conventional power generating stations. |
| CO-2 | Classify Distribution system and its design                                                         |
| CO-3 | Classify Substations                                                                                |
| CO-4 | Types of Underground cables                                                                         |
| CO-5 | Understand Economic aspects and tariff                                                              |

**Course Code: 19120406**

**Course Title: Electrical Machines – II**

|      |                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------------------------------|
| CO-1 | Demonstrate ability to understand operation and working of 3-Ph induction motor                                       |
| CO-2 | Analyze performance alternator when connected in parallel with infinite bus or with another alternator                |
| CO-3 | Determine the voltage regulation of alternator through indirect methods and parallel operation of alternators         |
| CO-4 | Demonstrate ability to understand the concepts of synchronous motor's working and methods to start synchronous motor. |
| CO-5 | Explain the working and starting methods of 1-phase induction motor                                                   |

**Course Code: 19123403**

**Course Title: Fluid Mechanics & Hydraulic Machinery**

|      |                                                                                                           |
|------|-----------------------------------------------------------------------------------------------------------|
| CO-1 | Define fundamental concepts of fluid mechanics as applied to civil engineering and environmental problems |
| CO-2 | Discuss and derive the fundamental mathematical equations of fluid mechanics                              |
| CO-3 | Solve the problems of water conveyance in pipes, orifices, mouthpieces, notches and weirs                 |
| CO-4 | Apply conservation laws to derive governing equations of fluid flows                                      |
| CO-5 | Compare hydrostatic and hydrodynamic forces                                                               |

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| <b>Course Code: 19124402</b>                                       |                                                                                                                                                    |
| <b>Course Title: Internet of things</b>                            |                                                                                                                                                    |
| CO-1                                                               | Understand IOT development cycles, infrastructure, challenges and requirements                                                                     |
| CO-2                                                               | Learn about the wired and wireless communication protocols implementation                                                                          |
| CO-3                                                               | Learn about privacy , Types of threats, and security challenges present in IOT and IOT clouds                                                      |
| CO-4                                                               | Analyze various measurement methods and errors and their impact on IOT development                                                                 |
| CO-5                                                               | Develop IOT based products for real life applications                                                                                              |
| <b>Course Code: 19120412</b>                                       |                                                                                                                                                    |
| <b>Course Title: Electrical Machines – II Lab</b>                  |                                                                                                                                                    |
| CO-1                                                               | Determine the efficiency and regulation of transformers and asses their performance.                                                               |
| CO-2                                                               | Determine the performance of 1-Ø Induction motor.                                                                                                  |
| CO-3                                                               | Determine the regulation of three–phase alternator by various methods                                                                              |
| CO-4                                                               | Find $X_d / X_q$ ratio of alternator and asses the performance of three–phase synchronous generator.                                               |
| CO-5                                                               | Experiment various tests on Induction motor for assessing its performance                                                                          |
| <b>Course Code: 19123411</b>                                       |                                                                                                                                                    |
| <b>Course Title: Fluid Mechanics &amp; Hydraulic Machinery Lab</b> |                                                                                                                                                    |
| CO-1                                                               | Define and Measure Fluid Properties.                                                                                                               |
| CO-2                                                               | Illustrate Flow Measuring Devices used in pipes, channels and Tanks                                                                                |
| CO-3                                                               | Analyze characteristics of broad crested weir.                                                                                                     |
| CO-4                                                               | Illustrate the characteristics of surface profiles in free and forced vibrations.                                                                  |
| <b>Course Code: 1920412</b>                                        |                                                                                                                                                    |
| <b>Course Title: Basic Automobile Engineering</b>                  |                                                                                                                                                    |
| CO-1                                                               | Compare different types of automobiles and their components                                                                                        |
| CO-2                                                               | Differentiate working principles of different types of automobile engines                                                                          |
| CO-3                                                               | Illustrate working of different transmission elements and control systems                                                                          |
| CO-4                                                               | Implement different types of safety systems                                                                                                        |
| CO-5                                                               | Implement effective pollution reduction methods                                                                                                    |
| <b>Course Outcomes for Third Year First Semester Course</b>        |                                                                                                                                                    |
| <b>Course Code: 19120503</b>                                       |                                                                                                                                                    |
| <b>Course Title: Control Systems</b>                               |                                                                                                                                                    |
| CO-1                                                               | Derive the transfer function of physical systems and determination of overall transferfunction using block diagram algebra and signal flow graphs. |
| CO-2                                                               | Determine time response specifications of second order systems and to determine error constants                                                    |
| CO-3                                                               | Analyze absolute and relative stability of LTI system using Routh's and the root locus method                                                      |
| CO-4                                                               | Analyze the stability of LTI systems using frequency response methods                                                                              |

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**Course Code: 19120504**

**Course Title: Power Systems-II**

|      |                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the parameters of various types of transmission lines and to understand the performance of short, medium, long transmission lines |
| CO-2 | Understand the effects of skin, proximity, Ferranti, corona effects on transmission lines                                                    |
| CO-3 | Understand the power system transients & sag, mechanical design of overhead lines and insulators                                             |
| CO-4 | Understand different methods of generation, distribution, control and compensation involved in the operation of power systems                |

**Course Code: 19124501**

**Course Title: Digital Electronics**

|      |                                                                                  |
|------|----------------------------------------------------------------------------------|
| CO-1 | Analyze different number systems, its conversions                                |
| CO-2 | Analyze different types of logic gates and fundamentals of karnaugh maps         |
| CO-3 | Understand the design of combinational and sequential circuits using logic gates |
| CO-4 | Understand the fundamentals of op-amps, its circuits and parameters              |

**Course Code: 19120565a**

**Course Title: Power system dynamics & control**

|      |                                                                                                |
|------|------------------------------------------------------------------------------------------------|
| CO-1 | Understand the power stability problems                                                        |
| CO-2 | Understand the basic concepts of modeling of synchronous machine and power system components   |
| CO-3 | Analyze the stability issues in interconnected systems                                         |
| CO-4 | Understand the power system stability analysis tools and enhancement of power system stability |

**Course Code: 19120565b**

**Course Title: Special electrical machines**

|      |                                                                               |
|------|-------------------------------------------------------------------------------|
| CO-1 | Explain theory of operation and control of switched reluctance motor          |
| CO-2 | Explain the performance and control of stepper motors, and their applications |
| CO-3 | Describe the operation and characteristics of permanent magnet dc motor       |
| CO-4 | Understand the operation and characteristics of brush less dc motor.          |

**Course Code: 19120565c**

**Course Title: Advanced control systems**

|      |                                                                               |
|------|-------------------------------------------------------------------------------|
| CO-1 | Explain theory of operation and control of switched reluctance motor          |
| CO-2 | Explain the performance and control of stepper motors, and their applications |
| CO-3 | Describe the operation and characteristics of permanent magnet dc motor       |
| CO-4 | Understand the operation and characteristics of brush less dc motor.          |

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| <b>Course Code: 19120565d</b>                          |                                                                                                                                                    |
| <b>Course Title: Advanced power conversion systems</b> |                                                                                                                                                    |
| <b>CO-1</b>                                            | Understands the basics in the electric power conversion using power switching devices                                                              |
| <b>CO-2</b>                                            | Evaluate the conversion for range of renewable energy sources with the help of available electrical machines drives                                |
| <b>CO-3</b>                                            | Analyzes the different energy storage systems                                                                                                      |
| <b>CO-4</b>                                            | Identify the various Industrial and domestic applications                                                                                          |
| <b>Course Code: 19123562e</b>                          |                                                                                                                                                    |
| <b>Course Title: Hybrid and Electric Vehicles</b>      |                                                                                                                                                    |
| <b>CO-1</b>                                            | Grade hybrid electric technology and electronic drive trains                                                                                       |
| <b>CO-2</b>                                            | Construction of hybrid electric vehicles                                                                                                           |
| <b>CO-3</b>                                            | Demonstrate electric vehicle components                                                                                                            |
| <b>CO-4</b>                                            | Construction of Electric vehicle technology                                                                                                        |
| <b>CO-5</b>                                            | Operate fuel cell technology and Identification of fuel cell based vehicles                                                                        |
| <b>Course Code: 19120512</b>                           |                                                                                                                                                    |
| <b>Course Title: Control Systems Lab</b>               |                                                                                                                                                    |
| <b>CO-1</b>                                            | Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs |
| <b>CO-2</b>                                            | Determine time response specifications of second order systems and to determine error constants                                                    |
| <b>CO-3</b>                                            | Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.                                |
| <b>CO-4</b>                                            | Analyze the stability of LTI systems using frequency response methods                                                                              |
| <b>Course Code: 19124511</b>                           |                                                                                                                                                    |
| <b>Course Title: Digital Electronics Lab</b>           |                                                                                                                                                    |
| <b>CO-1</b>                                            | Learn the basics of gates, flip-flops and counters                                                                                                 |
| <b>CO-2</b>                                            | Construct basic combinational circuits and verify their functionalities                                                                            |
| <b>CO-3</b>                                            | Apply the design procedures to design basic sequential circuits                                                                                    |
| <b>CO-4</b>                                            | Understand the basic digital circuits and to verify their operation                                                                                |
| <b>CO-5</b>                                            | Design ripple counter and synchronous counter                                                                                                      |
| <b>Course Code: 19129596</b>                           |                                                                                                                                                    |
| <b>Course Title: Constitution of India</b>             |                                                                                                                                                    |
| <b>CO-1</b>                                            | List the fundamental rights and duties                                                                                                             |
| <b>CO-2</b>                                            | Explain the union Government and state Government                                                                                                  |
| <b>CO-3</b>                                            | Explain the State Government and Administrative system                                                                                             |
| <b>CO-4</b>                                            | Explain the Local Administrative system                                                                                                            |

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| <b>Course Code: 19120521</b>                                   |                                                                                                                                    |
| <b>Course Title: Mini Project-I/ Study Project/ Internship</b> |                                                                                                                                    |
| <b>CO-1</b>                                                    | Achieve practical knowledge within his chosen area of technology for project development.                                          |
| <b>CO-2</b>                                                    | Identify, analyze, formulate and handle electronics & communications projects with a systematic and comprehensive approach.        |
| <b>CO-3</b>                                                    | Contribute as an individual or as member of team in development of technical projects.                                             |
| <b>CO-4</b>                                                    | Develop effective communication skills for presentation of project related activities.                                             |
| <b>Course Code: 19120522</b>                                   |                                                                                                                                    |
| <b>Course Title: Community service oriented project</b>        |                                                                                                                                    |
| <b>CO-1</b>                                                    | Achieve practical knowledge within his chosen area of technology for project development.                                          |
| <b>CO-2</b>                                                    | Identify, analyze, formulate and handle electronics & communications projects with asystematic and comprehensive approach.         |
| <b>CO-3</b>                                                    | Contribute as an individual or as member of team in development of technical projects.                                             |
| <b>CO-4</b>                                                    | Develop effective communication skills for presentation of project related activities.                                             |
| <b>Course Outcomes for Third Year Second Semester Course</b>   |                                                                                                                                    |
| <b>Course Code: 19120665a-Professional Elective - II</b>       |                                                                                                                                    |
| <b>Course Title: Utilization of electrical energy</b>          |                                                                                                                                    |
| <b>CO-1</b>                                                    | Identify most appropriate heating or welding techniques for suitable applications                                                  |
| <b>CO-2</b>                                                    | understand various level of luminosity produced by different illuminating sources                                                  |
| <b>CO-3</b>                                                    | Identify most appropriate heating or welding techniques for suitable applications                                                  |
| <b>CO-4</b>                                                    | understand various level of luminosity produced by different illuminating sources                                                  |
| <b>Course Code: 19120665b</b>                                  |                                                                                                                                    |
| <b>Course Title: Power semi-conductor drives</b>               |                                                                                                                                    |
| <b>CO-1</b>                                                    | Know the fundamentals of electric drive and different electric braking methods                                                     |
| <b>CO-2</b>                                                    | Analyze the operation of three phase converter controlled dc motors and four quadrantoperation of dc motors using dual converters. |
| <b>CO-3</b>                                                    | Know the converter control of dc motors in various quadrants                                                                       |
| <b>CO-4</b>                                                    | Know the concept of speed control of induction motor by using AC voltage controllers andvoltage source inverters                   |

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| <b>Course Code: 19120665c</b>                                                 |                                                                                                                                                            |
| <b>Course Title: Digital control systems</b>                                  |                                                                                                                                                            |
| <b>CO-1</b>                                                                   | Know the fundamentals of electric drive and different electric braking methods                                                                             |
| <b>CO-2</b>                                                                   | Analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.                        |
| <b>CO-3</b>                                                                   | Know the converter control of dc motors in various quadrants                                                                                               |
| <b>CO-4</b>                                                                   | Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters                                          |
| <b>Course Code: 19120665d</b>                                                 |                                                                                                                                                            |
| <b>Course Title: Solar energy systems</b>                                     |                                                                                                                                                            |
| <b>CO-1</b>                                                                   | Understand various terms in solar energy                                                                                                                   |
| <b>CO-2</b>                                                                   | Design solar collector plates                                                                                                                              |
| <b>CO-3</b>                                                                   | Understand solar heating and cooling systems and solar energy storage techniques                                                                           |
| <b>CO-4</b>                                                                   | Analyze the PV system applications and know the government support for solar energy                                                                        |
| <b>Course Code: 19124601</b>                                                  |                                                                                                                                                            |
| <b>Course Title: Power Electronics</b>                                        |                                                                                                                                                            |
| <b>CO-1</b>                                                                   | Demonstrate the characteristics of various power semiconductor devices                                                                                     |
| <b>CO-2</b>                                                                   | Analyze different electrical parameters of single phase AC-DC converters and semiconverters for different loads and to evaluate the converters performance |
| <b>CO-3</b>                                                                   | Analyze different DC-DC converters for different loads and to evaluate the converters performance.                                                         |
| <b>CO-4</b>                                                                   | Understand the working of AC-AC voltage regulators and cyclo-converters, inverters and application of PWM techniques for voltage and harmonic mitigation   |
| <b>Course Code: 19124601</b>                                                  |                                                                                                                                                            |
| <b>Course Title: Microprocessors &amp; Micro-controllers and applications</b> |                                                                                                                                                            |
| <b>CO-1</b>                                                                   | Do assembly language programming                                                                                                                           |
| <b>CO-2</b>                                                                   | Do interfacing design of peripherals like I/O, A/D, D/A, timer etc                                                                                         |
| <b>CO-3</b>                                                                   | Develop systems using different microcontrollers                                                                                                           |
| <b>CO-4</b>                                                                   | Learn hardware and software interaction and integration                                                                                                    |
| <b>Course Code: 19124603</b>                                                  |                                                                                                                                                            |
| <b>Course Title: Switch Gear &amp; Protection</b>                             |                                                                                                                                                            |
| <b>CO-1</b>                                                                   | Understand the principles of arc interruption for application to high voltage circuit breakers of air, oil, vacuum, SF6 gas type.                          |

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| <b>CO-2</b>                                                                       | Understand the working principle and constructional features of different types of electromagnetic protective relays                                                                                                                                                             |
| <b>CO-3</b>                                                                       | Knowledge of faults that is observed to occur in high power generator and transformers and protective schemes used for all protections                                                                                                                                           |
| <b>CO-4</b>                                                                       | Understand about static relays and various types of protective schemes used for feeders and bus bar protection                                                                                                                                                                   |
| <b>Course Code: 19124604</b>                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Course Title: Power system analysis</b>                                        |                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                                       | Draw an impedance diagram and SLD for a power system network and form a Y-bus matrix for a power system network with or without mutual couplings.                                                                                                                                |
| <b>CO-2</b>                                                                       | Find out the load flow solution of a power system network using different types of load flow methods                                                                                                                                                                             |
| <b>CO-3</b>                                                                       | Formulate the Z-bus for a power system network.                                                                                                                                                                                                                                  |
| <b>CO-4</b>                                                                       | Find out the fault currents for all types faults with a view to provide data for the design of protective devices                                                                                                                                                                |
| <b>Course Code: 19124611</b>                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Course Title: Microprocessors &amp; Micro-controllers and applications Lab</b> |                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                                       | Do assembly language programming                                                                                                                                                                                                                                                 |
| <b>CO-2</b>                                                                       | Do interfacing design of peripherals like I/O, A/D, D/A, timer etc                                                                                                                                                                                                               |
| <b>CO-3</b>                                                                       | Develop systems using different microcontrollers                                                                                                                                                                                                                                 |
| <b>CO-4</b>                                                                       | Do assembly language programming                                                                                                                                                                                                                                                 |
| <b>Course Code: 19120612</b>                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Course Title: Power Electronics Lab</b>                                        |                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                                       | Know the characteristics of various power electronic devices and Analyze firing circuit and commutation circuits of SCR                                                                                                                                                          |
| <b>CO-2</b>                                                                       | Analyze the performance of single phase and three phase full wave bridge converters, single phase dual converter with both resistive and inductive loads                                                                                                                         |
| <b>CO-3</b>                                                                       | Understand the operation of AC voltage controller and cycle converter with resistive and inductive loads                                                                                                                                                                         |
| <b>CO-4</b>                                                                       | Understand the working of Buck converter, Boost converter, single phase bridge inverter and PWM inverter.                                                                                                                                                                        |
| <b>Course Code: 19129696</b>                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Course Title: Soft Skills</b>                                                  |                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                                       | Construct coherent, cohesive and unambiguous verbal expressions in both oral and written discourses.                                                                                                                                                                             |
| <b>CO-2</b>                                                                       | Analyze the given data/text and find out the correct responses to the questions asked based on their aiding exercises; identify relationships or patterns within groups of words or sentences                                                                                    |
| <b>CO-3</b>                                                                       | Write paragraphs on a particular topic, essays (issues and arguments), e-mails, summaries of group discussions, reports, make notes, statement of purpose (for admission into foreign universities), letters of recommendation (for professional and educational purposes).      |
| <b>CO-4</b>                                                                       | Converse with ease during interactive sessions/seminars in their classrooms, compete in literary activities like elocution, debates etc., raise doubts in class, participate in JAM sessions/variant tests with confidence and convey oral information in a professional manner. |

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## GR-19 B.Tech Mechanical Engineering

### B.TECH–MECHANICAL ENGINEERING

**Department Vision:** To be recognized as a Global Centre of Excellence in Mechanical Engineering Education, Research and Consultancy

**Department Mission:** Department of Mechanical Engineering strives to provide scope for all round development of the students and staff by engaging them in various activities such as

Participative learning so that students internalize their classroom learning practices.

Student centric learning practices such as summary sessions, learn-ahead-of class, problem solving.

Extensive practical courses to foster learning by observation.

Exposing students, faculty and staff to various industrial practices and usage of modern tools to reinforce their classroom/laboratory learning.

Sensitization towards importance of ethical practice, societal responsibility, leadership skills,

Entrepreneurship skills, communication skills and lifelong learning.

#### Program Educational Objectives (PEOs):

|             |                                                                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PEO1</b> | Working professional in Mechanical Engineering field or other disciplines to develop products, processes to solve Mechanical Engineering related or other problems for betterment of society. |
| <b>PEO2</b> | Pursuing further education to enrich their knowledge in Mechanical Engineering or other fields.                                                                                               |
| <b>PEO3</b> | Undertaking entrepreneurial ventures in Mechanical Engineering or other disciplines.                                                                                                          |

#### Program Specific Outcomes (PSO's):

|             |                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b> | Join a technically sophisticated workforce as successful professionals in a wide range of mechanical engineering and related fields.  |
| <b>PSO2</b> | Continuously improve and expand their technical and professional skills through formal means as well as through informal self-study.  |
| <b>PSO3</b> | Pursue advanced degrees in engineering, business, or other professional fields.                                                       |
| <b>PSO4</b> | Advance themselves professionally and personally by accepting professional and social responsibilities and pursuing leadership roles. |

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**Program Outcomes (POs): Engineering Graduates will be able to:**

|    |                                                                                                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Apply fundamental knowledge of Science, Mathematics and Engineering principles in solving problems related to Mechanical Engineering.                                                 |
| 2  | Apply principles of design engineering, thermal engineering, production engineering and industrial engineering to arrive at a physically meaningful analysis of engineering problems. |
| 3  | Present feasible designs for simple domestic and industrial Mechanical Engineering problems through drawings and other multimedia tools to meet desired needs.                        |
| 4  | Identify, formulate and solve Mechanical engineering problems through rigorous research methodology.                                                                                  |
| 5  | Use Drafting, Modeling and Analysis Software and/or hardware tools for meaningful and economically viable Engineering practice.                                                       |
| 6  | Apply knowledge of Thermal, Design, Automation Technologies and Management principles to inter-disciplinary engineering problems and their societal implications.                     |
| 7  | Understand and propose, where ever possible, environment-friendly and sustainable solutions to Mechanical Engineering problems.                                                       |
| 8  | Expertise in following ethical code of conduct in professional activities.                                                                                                            |
| 9  | Use their analytical, teamwork, leadership skills in the development of products and provide solutions to problems sought by local and/or global community.                           |
| 10 | Communicate verbally, textually and graphically to collaborate effectively towards engineering activities                                                                             |
| 11 | Inspire confidence in team members to realize the goals of the organization and manage finances an sizeable projects by choosing the right blend of common sense solutions.           |
| 12 | Develop confidence and a sense of curiosity towards life-long learning to adapt to ever changing technologies.                                                                        |

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**Course outcomes (Cos) of all courses of all programs offered by the institution**

|                                                                              |                                                                                                                                                                                                |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course outcomes for First Year First Semester Course</b>                  |                                                                                                                                                                                                |
| <b>Course Code:19198101</b>                                                  |                                                                                                                                                                                                |
| <b>Course Title: Mathematics - I</b>                                         |                                                                                                                                                                                                |
| CO1:                                                                         | Transform the knowledge of solving system of linear equations using matrices.                                                                                                                  |
| CO2:                                                                         | Evaluate nature of the Quadratic form.                                                                                                                                                         |
| CO3:                                                                         | Acquire the knowledge maxima and minima of function of several variables.                                                                                                                      |
| CO4:                                                                         | Evaluate multiple integrals and their applications.                                                                                                                                            |
| CO5:                                                                         | Understand and apply vector derivatives and vector integration theorems.                                                                                                                       |
| <b>Course Code:19198102</b>                                                  |                                                                                                                                                                                                |
| <b>Course Title: Communicative English-I</b>                                 |                                                                                                                                                                                                |
| CO1:                                                                         | Develop effective reading strategies                                                                                                                                                           |
| CO2:                                                                         | Demonstrate writing skills that are required for professional development and use graphic elements for communication.                                                                          |
| CO3:                                                                         | Apply grammatical skills and vocabulary effectively in speech and writing                                                                                                                      |
| CO4:                                                                         | Display language efficacy in tune with subjective knowledge                                                                                                                                    |
| CO5:                                                                         | Use required language along with contextual vocabulary and grammar structures                                                                                                                  |
| <b>Course Code: 19198103</b>                                                 |                                                                                                                                                                                                |
| <b>Course Title: Engineering Chemistry</b>                                   |                                                                                                                                                                                                |
| CO1:                                                                         | Understand the removal techniques of hardness of water                                                                                                                                         |
| CO2:                                                                         | Distinguish the fuel cells and batteries                                                                                                                                                       |
| CO3:                                                                         | Identify different control techniques of corrosion                                                                                                                                             |
| CO4:                                                                         | Understand the concepts of plastics and rubbers                                                                                                                                                |
| CO5:                                                                         | Analyse the importance of nanomaterials.                                                                                                                                                       |
| <b>Course Code:19199104</b>                                                  |                                                                                                                                                                                                |
| <b>Course Title: Basic Electrical and Electronics Engineering</b>            |                                                                                                                                                                                                |
| CO1:                                                                         | Analyze the various electrical networks                                                                                                                                                        |
| CO2:                                                                         | Understand the operation of DC machines, 3-point starter and conduct the Swinburne's Test.                                                                                                     |
| CO3:                                                                         | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                                                                          |
| CO4:                                                                         | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                                                                                             |
| CO5:                                                                         | Explain the single stage CE amplifier and concept of feedback amplifier.                                                                                                                       |
| <b>Course Code :19198105</b>                                                 |                                                                                                                                                                                                |
| <b>Course Title: Professional Ethics &amp; Human Values</b>                  |                                                                                                                                                                                                |
| CO1:                                                                         | Create awareness on professional ethics and Human values                                                                                                                                       |
| CO2:                                                                         | Create awareness on engineering ethics providing basic knowledge about engineering ethics, Variety of moral dilemmas Professional ideas and virtues                                            |
| CO3:                                                                         | Provide basic familiarity about engineers as responsible experimenters, Research ethics, codes of ethics, Industrial standards                                                                 |
| CO4:                                                                         | Inculcate knowledge and exposure on safety and risk, risk benefit analysis and have an idea about collective bargaining, confidentiality, professional, employee, intellectual property rights |
| CO5:                                                                         | Have an adequate knowledge about MNC's Business environment, computer ethics moral leadership Sample code of conduct, cyber crime                                                              |
| <b>Course Code: 19198176</b>                                                 |                                                                                                                                                                                                |
| <b>Course Title: Engineering Graphics</b>                                    |                                                                                                                                                                                                |
| CO1:                                                                         | Apply principles of drawing to represent dimensions of an object.                                                                                                                              |
| CO2:                                                                         | Outline the polygons and engineering curves.                                                                                                                                                   |
| CO3:                                                                         | Illustrate projections of points, lines, planes and solids.                                                                                                                                    |
| CO4:                                                                         | Illustrate the 3D views through isometric views.                                                                                                                                               |
| CO5:                                                                         | Create the isometric views and orthographic views                                                                                                                                              |
| <b>Course Code: 19198112</b>                                                 |                                                                                                                                                                                                |
| <b>Course Title: Engineering Chemistry Laboratory</b>                        |                                                                                                                                                                                                |
| CO1:                                                                         | Explain the functioning of the instruments such as pH, conductivity, and potentiometric meters.                                                                                                |
| CO2:                                                                         | Determine the total hardness of water                                                                                                                                                          |
| CO3:                                                                         | Perform various redox titrations.                                                                                                                                                              |
| CO4:                                                                         | Preparation of polymers                                                                                                                                                                        |
| CO5:                                                                         | Compare viscosities of different oils                                                                                                                                                          |
| <b>Course Code: 19199113</b>                                                 |                                                                                                                                                                                                |
| <b>Course Title: Basic Electrical and Electronics Engineering Laboratory</b> |                                                                                                                                                                                                |
| CO1:                                                                         | Analyze the various electrical networks                                                                                                                                                        |
| CO2:                                                                         | Understand the operation or DC machines, 3-point starter and conduct the                                                                                                                       |

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|                                                               | Swinburne's Test.                                                                                                                                                                                                                                                                                                                                            |
| CO3:                                                          | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                                                                                                                                                                                                                                        |
| CO4:                                                          | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                                                                                                                                                                                                                                                           |
| CO5:                                                          | Explain the single stage CE amplifier and concept of feedback amplifier.                                                                                                                                                                                                                                                                                     |
| <b>Course outcomes for First Year Second Semester Course</b>  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Code:19198201</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Mathematics – II</b>                         |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                          | Solve first order differential equations.                                                                                                                                                                                                                                                                                                                    |
| CO2:                                                          | Solve higher order differential equations with constant coefficients                                                                                                                                                                                                                                                                                         |
| CO3:                                                          | Apply the knowledge of approximating and find the roots of polynomial and transcendental equation in practical engineering problems.                                                                                                                                                                                                                         |
| CO4:                                                          | Understand numerical differentiation and integration.                                                                                                                                                                                                                                                                                                        |
| CO5:                                                          | Apply the knowledge of different algorithms for approximating the solution of ordinary differential equations in practical engineering problems.                                                                                                                                                                                                             |
| <b>Course Code:19198202</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Communicative English-II</b>                 |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                          | Paraphrase short academic texts using suitable strategies and conventions                                                                                                                                                                                                                                                                                    |
| CO2:                                                          | Make formal structured presentations on academic topics using PPT slides with relevant graphical elements                                                                                                                                                                                                                                                    |
| CO3:                                                          | Build the ability to convey in different communicative forms.                                                                                                                                                                                                                                                                                                |
| <b>Course Code:19198203</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Physics and its Applications</b> |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                          | To impart knowledge of physical optical phenomenon like Interference, Diffraction and polarization involving design of optical instruments with higher resolution. To explain the concept of dielectric constant and polarization in dielectric materials and summarize Gauss's law in the presence of dielectrics                                           |
| CO2:                                                          | To assess the electromagnetic wave propagation in different media and its power and explain the working principle of optical fibers and its classification based on refractive index profile and mode of propagation with their applications. To classify the energy bands of semiconductors and outline the properties of n-type and p-type semiconductors. |
| CO3:                                                          | To study the basic Quantum mechanics, interpretation of the direct and indirect band gap in semiconductors and identify the type of semiconductor using Hall effect.                                                                                                                                                                                         |
| CO4:                                                          | To interpret dielectric loss, Lorentz field and Clausius - Mosotti relation and classify the magnetic materials based on susceptibility and their temperature dependence. To apply the Gauss' Theorem for divergence and Stokes' theorem for curl and evaluate Maxwell's displacement current and correction in Ampere's law.                                |
| <b>Course Code:19199204</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Problem Solving &amp; Programming in C</b>   |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                          | Obtain the knowledge about different languages used in computer programming and basic terminology used in the computer programming.                                                                                                                                                                                                                          |
| CO2:                                                          | Write algorithm, flow chart, and structure of C program and make use of different C tokens inside C program.                                                                                                                                                                                                                                                 |
| CO3:                                                          | Develop program by using Control structure, different looping and Jump statement.                                                                                                                                                                                                                                                                            |
| CO4:                                                          | Implement applications of Array, Structure and String inside the program.                                                                                                                                                                                                                                                                                    |
| CO5:                                                          | Obtain knowledge about accessing the memory in the program and also to develop the program by using different types of function calls.                                                                                                                                                                                                                       |
| <b>Course Code: 19198205</b>                                  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Environmental Studies</b>                    |                                                                                                                                                                                                                                                                                                                                                              |
| CO1:                                                          | Gain a higher level of personal involvement and interest in understanding and solving environmental problems.                                                                                                                                                                                                                                                |
| CO2:                                                          | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities                                                                                                                                                                                                                           |
| CO3:                                                          | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century                                                                                                                                                                                                                             |
| CO4:                                                          | Recognize the interconnectedness of human dependence on the earth's ecosystems                                                                                                                                                                                                                                                                               |
| CO5:                                                          | Influence their society in proper utilization of goods and services.                                                                                                                                                                                                                                                                                         |
| <b>Course Code: 19198206</b>                                  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Mechanics</b>                    |                                                                                                                                                                                                                                                                                                                                                              |

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| CO1:                                                                      | Carry out composition of system of forces.                                                                                                                                                                                            |
| CO2:                                                                      | Analyse rigid bodies in static equilibrium condition under system of forces including friction.                                                                                                                                       |
| CO3:                                                                      | Determine centre of gravity and moment of inertia of simple and composite planar, solid sections.                                                                                                                                     |
| CO4:                                                                      | Carry out dynamic analysis of rigid bodies under translation, rotation and plane motion.                                                                                                                                              |
| CO5:                                                                      | Apply work energy and impulse momentum principles to rigid body motion.                                                                                                                                                               |
| <b>Course Code:19198211</b>                                               |                                                                                                                                                                                                                                       |
| <b>Course Title: Communicative English Laboratory-II</b>                  |                                                                                                                                                                                                                                       |
| CO1:                                                                      | Learn to communicate in English                                                                                                                                                                                                       |
| CO2:                                                                      | Comprehend native speaker's accent                                                                                                                                                                                                    |
| CO3:                                                                      | Speak appropriately in real life situations                                                                                                                                                                                           |
| CO4:                                                                      | Display public speaking skills in the required context                                                                                                                                                                                |
| CO5:                                                                      | Handle different communicative situations                                                                                                                                                                                             |
| <b>Course Code:19198212</b>                                               |                                                                                                                                                                                                                                       |
| <b>Course Title: Engineering Physics Laboratory</b>                       |                                                                                                                                                                                                                                       |
| CO1:                                                                      | To handle optical instruments like microscope and spectrometer, determine thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colors using diffraction grating |
| CO2:                                                                      | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance                       |
| CO3:                                                                      | To evaluate the acceleration due to gravity using compound pendulum                                                                                                                                                                   |
| CO4:                                                                      | To determine the moment of inertia using Fly wheel                                                                                                                                                                                    |
| <b>Course Code:19199213</b>                                               |                                                                                                                                                                                                                                       |
| <b>Course Title: Problem Solving &amp; Programming Laboratory using C</b> |                                                                                                                                                                                                                                       |
| CO1:                                                                      | Obtain the knowledge about different languages used in computer programming and basic terminology used in the computer programming.                                                                                                   |
| CO2:                                                                      | Write algorithm, flow chart, and structure of C program and make use of different C tokens inside C program.                                                                                                                          |
| CO3:                                                                      | Develop program by using Control structure, different looping and Jump statement.                                                                                                                                                     |
| CO4:                                                                      | Implement applications of Array, Structure and String inside the program.                                                                                                                                                             |
| CO5:                                                                      | Obtain knowledge about accessing the memory in the program and also to develop the program by using different types of function calls.                                                                                                |
| <b>Course Code: 19198214</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: Basic Engineering Workshop</b>                           |                                                                                                                                                                                                                                       |
| CO1:                                                                      | Experiment with various basic house wiring techniques.                                                                                                                                                                                |
| CO2:                                                                      | Develop basic prototype in the trade of tin smithy such as square tray and open scoop.                                                                                                                                                |
| CO3:                                                                      | Design v-fitting and square fitting in the trade of fitting                                                                                                                                                                           |
| CO4:                                                                      | Making square rod and L-bend from the round rod in black smithy                                                                                                                                                                       |
| CO5:                                                                      | Build various prototype like T lap joint, dovetail joint, cross lap etc. in the trade of carpentry.                                                                                                                                   |
| <b>Course Outcomes for Second Year First Semester Course</b>              |                                                                                                                                                                                                                                       |
| <b>Course Code:19130303</b>                                               |                                                                                                                                                                                                                                       |
| <b>Course Title: Mechanics of Solids</b>                                  |                                                                                                                                                                                                                                       |
| CO-1                                                                      | Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.                                                                                               |
| CO-2                                                                      | Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings.                                                                                                     |
| CO-3                                                                      | Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural.                                                                                                             |

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| CO-4                                                               | Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.                           |
| CO-5                                                               | Able to calculate the failure load of column and struts with different type of end condition.                                      |
| <b>Course Code:19130304</b>                                        |                                                                                                                                    |
| <b>Course Title: Kinematics of Machinery</b>                       |                                                                                                                                    |
| CO-1                                                               | Explain about the mobility and inversions of a planar mechanism.                                                                   |
| CO-2                                                               | Discuss mechanisms with lower pairs                                                                                                |
| CO-3                                                               | Determine the velocity and acceleration for the planar mechanisms                                                                  |
| CO-4                                                               | Analyse the motion of the cams and followers.                                                                                      |
| CO-5                                                               | Analyse Gears and Gear Trains                                                                                                      |
| <b>Course Code:19130305</b>                                        |                                                                                                                                    |
| <b>Course Title: Thermodynamics</b>                                |                                                                                                                                    |
| CO-1                                                               | Explain the importance of thermodynamic properties related to conversion of heat energy into work.                                 |
| CO-2                                                               | Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, IC engines, compressors and nozzles.                       |
| CO-3                                                               | Utilize steam properties in components of heat engines running with steam.                                                         |
| CO-4                                                               | Compare air standard cycles using thermodynamic relations.                                                                         |
| CO-5                                                               | Apply thermodynamics in solving engineering problems relates heat and work                                                         |
| <b>Course Code:19130306</b>                                        |                                                                                                                                    |
| <b>Course Title: Fluid Mechanics &amp; Hydraulic Machinery</b>     |                                                                                                                                    |
| CO-1                                                               | Discuss the properties of fluids, pressure and its measurement.                                                                    |
| CO-2                                                               | Identify the types lines, flows and derive continuity equation, Bernoulli's equation and Buckingham's $\pi$ theorem.               |
| CO-3                                                               | Examine the energy losses in pipes and sketch EGL. Discuss about the flow measuring devices. Learn the concepts of boundary layer. |
| CO-4                                                               | Describe working of hydraulic turbines and performance characteristics.                                                            |
| CO-5                                                               | Describe working centrifugal and reciprocating pumps and its performance.                                                          |
| <b>Course Code: 19130311</b>                                       |                                                                                                                                    |
| <b>Course Title: Mechanics of Solids &amp; Metallurgy lab</b>      |                                                                                                                                    |
| CO-1                                                               | Determine the Young's Modulus for ductile materials and analyze the various points on stress strain diagram.                       |
| CO-2                                                               | Analyze& compare the hardness values for various materials.                                                                        |
| CO-3                                                               | Understand various micro structures and relationship to properties.                                                                |
| CO-4                                                               | Compare the Micro structures of Ferrous & Non-Ferrous Alloys.                                                                      |
| CO-5                                                               | Improving material properties by different heat treatment processes.                                                               |
| <b>Course Code:19130312</b>                                        |                                                                                                                                    |
| <b>Course Title: Fluid Mechanics &amp; Hydraulic Machinery Lab</b> |                                                                                                                                    |
| CO-1                                                               | Understand the concept of flow measuring devices and determine the coefficient of discharge of Venturimeter and Orifice meter      |
| CO-2                                                               | Apply the knowledge of Centrifugal pump and Reciprocating pump in real life situations and find out the                            |

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|                                                                        | performance of pumps.                                                                                                                            |
| CO-3                                                                   | Evaluate the performance parameters of hydraulic turbines Pelton wheel and Francis turbine.                                                      |
| CO-4                                                                   | Understand the concept of flow through pipes and determine the losses.                                                                           |
| CO-5                                                                   | Justify the Bernoulli's theorem                                                                                                                  |
| <b>Course Outcomes for Second Year Second Semester Course</b>          |                                                                                                                                                  |
| <b>Course Code:19139401</b>                                            |                                                                                                                                                  |
| <b>Course Title:Numerical Methods and Probability &amp; Statistics</b> |                                                                                                                                                  |
| CO-1                                                                   | Apply the knowledge of approximating and find the roots of polynomial and transcendental equation in practical engineering problems.             |
| CO-2                                                                   | Apply the knowledge of different algorithms for approximating the solution of ordinary differential equations in practical Engineering problems. |
| CO-3                                                                   | Demonstrate the knowledge of probability distributions                                                                                           |
| CO-4                                                                   | Enhance knowledge of a classical hypothesis techniques                                                                                           |
| CO-5                                                                   | Enhance knowledge in inferential methods based on small and large sampling tests.                                                                |
| <b>Course Code:19130402</b>                                            |                                                                                                                                                  |
| <b>Course Title: Dynamics of Machinery</b>                             |                                                                                                                                                  |
| CO-1                                                                   | Analyze stabilization of sea vehicles, aircrafts and automobile vehicle.                                                                         |
| CO-2                                                                   | Investigate the frictional losses & torque transmission of mechanical systems.                                                                   |
| CO-3                                                                   | Design the flywheels and governors for suitable applications.                                                                                    |
| CO-4                                                                   | Identify and Solve the unbalanced forces in reciprocating and rotary masses.                                                                     |
| CO-5                                                                   | Explain the concepts of free and forced vibrations of single degree freedom systems.                                                             |
| <b>Course Code:19130403</b>                                            |                                                                                                                                                  |
| <b>Course Title:Thermal Engineering -I</b>                             |                                                                                                                                                  |
| CO-1                                                                   | Analyse all the thermodynamic relations of IC Engines & Air Compressors                                                                          |
| CO-2                                                                   | Classify various types of IC Engines, Air compressors & cycle of operations                                                                      |
| CO-3                                                                   | Demonstrate the effect of various operating variables on engine performance                                                                      |
| CO-4                                                                   | Estimate performance and various efficiencies of IC Engine & Air compressors                                                                     |
| CO-5                                                                   | Design and evaluate performance and various efficiencies of IC Engine & Air compressors.                                                         |
| <b>Course Code:19130404</b>                                            |                                                                                                                                                  |
| <b>Course Title: Production Technology</b>                             |                                                                                                                                                  |
| CO-1                                                                   | Understand principles of sand casting processes.                                                                                                 |
| CO-2                                                                   | Discuss various casting methods and melting methods.                                                                                             |
| CO-3                                                                   | Demonstrate welding methods and their applications.                                                                                              |
| CO-4                                                                   | Explain metal forming methods such as rolling, forging, extrusion and sheet metal forming methods.                                               |
| CO-5                                                                   | Interpret the methods of fabrication of different plastics.                                                                                      |

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**Course Code: 19130411**

**Course Title: Computer Aided Drawing Practice**

|      |                                                                            |
|------|----------------------------------------------------------------------------|
| CO-1 | Illustrate the importance of CAD package and its basic commands.           |
| CO-2 | Produce the orthographic projections of regular solids.                    |
| CO-3 | Develop the lateral surfaces of regular solids and interpenetration curves |
| CO-4 | Convert to Isometric drawings and 3D Surface Models.                       |
| CO-5 | Connect simple parts using CAD Package                                     |

**Course Code: 19130412**

**Course Title: Thermal Engineering Lab**

|      |                                                                                                                             |
|------|-----------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Calculate various powers, efficiencies and energy balance for several types of Internal Combustion Engines and compressors. |
| CO-2 | Classify various types of IC Engines, Air compressors & cycle of operations                                                 |
| CO-3 | Demonstrate the effect of various operating variables on engine performance                                                 |
| CO-4 | Estimate properties of various fuels and lubricants.                                                                        |
| CO-5 | Evaluate Coefficient of Performance of Refrigeration and Air-conditioning units                                             |

**Course Code:19130413**

**Course Title: Production Technology Lab**

|      |                                                                                                                                    |
|------|------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the fundamentals of pattern making, melding process./understand the pattern design and making using wood turning lathe. |
| CO-2 | Gain knowledge in sand casting processes.                                                                                          |
| CO-3 | Learn on Welding processes like MMAW. Gas welding and cutting , TIG , MIG welding and resistance process.                          |
| CO-4 | Gain knowledge on sheet metal cutting and operations, extrusion.                                                                   |
| CO-5 | Understand the fabrication methods of plastics using injection and blow moulding.                                                  |

**Course outcomes for Third Year First Semester Course**

**Course Code:19130501**

**Course Title: Design of Machine Members**

|      |                                                                                                    |
|------|----------------------------------------------------------------------------------------------------|
| CO-1 | Describe the concepts of basic machine elements.                                                   |
| CO-2 | Identify the preferred sizes, codes and selection of proper material for design of machine element |
| CO-3 | Design the machine element under static and dynamic loading conditions.                            |
| CO-4 | Choose the temporary and permanent joints required to assemble the machine elements.               |
| CO-5 | Suggest the required spring for the given application.                                             |

**Course Code:19130502**

**Course Title: Thermal Engineering -II**

|      |                                                                                                     |
|------|-----------------------------------------------------------------------------------------------------|
| CO-1 | Analyze the thermal power plants and different methods to improve plant efficiency.                 |
| CO-2 | Evaluate the performance of various steam nozzles.                                                  |
| CO-3 | Examine various efficiencies of Condensers and steam turbines.                                      |
| CO-4 | Discuss gas turbines working principle and different methods to improve thermal efficiencies of gas |

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|                                                               | turbines.                                                                                                                                         |
| CO-5                                                          | Choose optimal parameters of jet propulsion units.                                                                                                |
| <b>Course Code:</b> 19130503                                  |                                                                                                                                                   |
| <b>Course Title:</b> Metal Cutting & Machine Tools            |                                                                                                                                                   |
| CO-1                                                          | Explain the cutting tool geometry, chip formation and cutting forces.                                                                             |
| CO-2                                                          | Describe the various parts and operations of machine tools viz. lathe, shaper, planer, drilling, boring, milling, grinding and broaching machine. |
| CO-3                                                          | Identify various machine tools viz. lathe, shaper, planer, drilling, boring, milling and grinding machine for various applications.               |
| CO-4                                                          | Discuss various principles and applications of jigs and fixtures .                                                                                |
| CO-5                                                          | Explain the working principles o fvarious Non Traditional Machining.                                                                              |
| <b>Course Code:</b> 19130564A                                 |                                                                                                                                                   |
| <b>Course Title:</b> A. Fuels Combustion and Emission control |                                                                                                                                                   |
| CO-1                                                          | Describe various types of fuels, combustion equations, adiabatic flame temperature and pollutant concentration.                                   |
| CO-2                                                          | Examine various properties of fuels and their analysis.                                                                                           |
| CO-3                                                          | Identify the various factors responsible for laminar and turbulent flame propagation.                                                             |
| CO-4                                                          | Use different principles of flame stabilization and ignition to design combustor.                                                                 |
| CO-5                                                          | Categorize emissions associated with combustion and identify their control techniques.                                                            |
| <b>Course Code:</b> 19130564B                                 |                                                                                                                                                   |
| <b>Course Title:</b> B. Tribology                             |                                                                                                                                                   |
| CO-1                                                          | Describe the viscosity and laws of fluid flow with reference to lubrication.                                                                      |
| CO-2                                                          | Examine hydrodynamic and hydrostatic properties of lubricants.                                                                                    |
| CO-3                                                          | Explain the journal and slider bearings under different load carrying conditions.                                                                 |
| CO-4                                                          | Describe the oil flow through bearings under different pressures and with thermal equilibrium conditions.                                         |
| CO-5                                                          | Analyze the behaviour of tribological components and measures subjected to different working conditions.                                          |
| <b>Course Code:</b> 19130564C                                 |                                                                                                                                                   |
| <b>Course Title:</b> C. Industrial Robotics                   |                                                                                                                                                   |
| CO-1                                                          | Discuss the fundamental components and coordinate systems of different industrial robots.                                                         |
| CO-2                                                          | Explain different types of drives used in robots and end effectors.                                                                               |
| CO-3                                                          | Solve the mathematical formulation for robot link movement.                                                                                       |
| CO-4                                                          | Analyze the kinematics of robot arm.                                                                                                              |
| CO-5                                                          | Identify the robot for different industrial applications with suitable robot programming.                                                         |
| <b>Course Code:</b> 19130564D                                 |                                                                                                                                                   |
| <b>Course Title:</b> D. Advanced Materials                    |                                                                                                                                                   |
| CO-1                                                          | Discuss the composites and their classification.                                                                                                  |
| CO-2                                                          | Describe polymer composites and their manufacturing methods.                                                                                      |
| CO-3                                                          | Analyze the mechanical behaviour of composite laminates.                                                                                          |
| CO-4                                                          | Investigate properties and applications of functionally graded materials and shape memory alloys.                                                 |

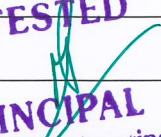
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|                                                    |                                                                                              |
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| CO-5                                               | Explain the properties, applications of nano materials and bio materials.                    |
| <b>Course Code:</b> 19131565a                      |                                                                                              |
| <b>Course Title:</b> Solid Waste Management        |                                                                                              |
| CO-1                                               | Under the objects of solid waste management                                                  |
| CO-2                                               | Under the elements of solid waste management                                                 |
| CO-3                                               | Design the transportation facility in solid waste management                                 |
| CO-4                                               | Characterize the solid waste and design a composting facility                                |
| CO-5                                               | Know the criteria for selection of landfill                                                  |
| <b>Course Code:</b> 19132565a                      |                                                                                              |
| <b>Course Title:</b> Energy management             |                                                                                              |
| CO-1                                               | The students shall have an understanding of the impact of energy on society                  |
| CO-2                                               | The need for sustainable energy ,global and Indian energy policies                           |
| CO-3                                               | They would have gained knowledge on various techniques of energy management and conservation |
| CO-4                                               | They would also have gained the basic ideas of conducting an energy audit                    |
| <b>Course Code:</b> 19134565a                      |                                                                                              |
| <b>Course Title:</b> Digital Image Processing      |                                                                                              |
| CO-1                                               | Understand the fundamental steps in digital image processing                                 |
| CO-2                                               | Examine various types of images ,intensity transformations and spatial filtering             |
| CO-3                                               | Develop fourier transform for image processing in frequency domain                           |
| CO-4                                               | Evaluate the methodologies for image restoration and segmentation                            |
| CO-5                                               | Understand colour image processing models                                                    |
| <b>Course Code:</b> 19135565a                      |                                                                                              |
| <b>Course Title:</b> Information Security          |                                                                                              |
| CO-1                                               | Evaluate vulnerability of an information system and establish a plan for risk management     |
| CO-2                                               | Demonstrate basic principles of web application security                                     |
| CO-3                                               | Evaluate the authentication and encryption needs of an information system                    |
| CO-4                                               | Demonstrate how to secure any work and evaluate a company's security policies and procedures |
| <b>Course Code:</b> 19136565a                      |                                                                                              |
| <b>Course Title:</b> Disaster Management in Mining |                                                                                              |
| CO-1                                               | Comprehend the concepts of hazard and disaster management                                    |
| CO-2                                               | Assess the types of hazards and their consequences                                           |
| CO-3                                               | Comprehend then approaches and measures in disaster management                               |
| CO-4                                               | Comprehend the statutory provisions related to disaster management in india                  |
| <b>Course Code:</b> 19137565a                      |                                                                                              |
| <b>Course Title:</b> Hybrid and Electric Vehicles  |                                                                                              |
| CO-1                                               | Operate of fuel cell technology                                                              |
| CO-2                                               | Identification of fuel based vehicles                                                        |

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|                                                              |                                                                                                                                           |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| CO-3                                                         | Determination of hybrid electric technology and electronic drive trains                                                                   |
| CO-4                                                         | Construction of hybrid electric vehicles                                                                                                  |
| CO-5                                                         | Construction of hybrid electric vehicle technology                                                                                        |
| <b>Course Code:</b> 19193511                                 |                                                                                                                                           |
| <b>Course Title:</b> Theory of Machines Lab                  |                                                                                                                                           |
| CO-1                                                         | Assess the gyroscopic effect and angular displacement of cam follower.                                                                    |
| CO-2                                                         | Analyze the characteristic curves of different governors.                                                                                 |
| CO-3                                                         | Illustrate about different types of gears and four bar mechanism.                                                                         |
| CO-4                                                         | Evaluate simple and compound screw jack.                                                                                                  |
| CO-5                                                         | Analyze different types of vibration systems and spring mass systems.                                                                     |
| <b>Course Code:</b> 19193512                                 |                                                                                                                                           |
| <b>Course Title:</b> Machine Tools Lab.                      |                                                                                                                                           |
| CO-1                                                         | Perform step and taper turning, thread cutting, knurling and boring operations on cylindrical work pieces using lathe machine.            |
| CO-2                                                         | Produce prismatic parts with desired surface finish using surface grinding machine and tool angles using tool and cutter grinder machine. |
| CO-3                                                         | Perform indexing to machine spur gears on milling machine.                                                                                |
| CO-4                                                         | Execute sequence of operations on slotting and shaping machines to generate keyways and splines on the given work piece.                  |
| CO-5                                                         | Carry out drilling and tapping operations to produce desired hole pattern on the given job.                                               |
| <b>Course Code:</b> 19139513                                 |                                                                                                                                           |
| <b>Course Title:</b> Soft Skills                             |                                                                                                                                           |
| CO-1                                                         | Understand the necessity to improve four language skills                                                                                  |
| CO-2                                                         | Acquire knowledge about public speaking ability                                                                                           |
| CO-3                                                         | Strengthen their grammatical skills in the language                                                                                       |
| CO-4                                                         | Improve necessary vocabulary and academic writing skills                                                                                  |
| CO-5                                                         | Improve academic writing skills                                                                                                           |
| <b>Course outcomes for Third Year Second Semester Course</b> |                                                                                                                                           |
| <b>Course Code:</b> 19130601                                 |                                                                                                                                           |
| <b>Course Title:</b> Design of Transmission Elements         |                                                                                                                                           |
| CO-1                                                         | Find required sizes of shaft, keys and couplings for the given application.                                                               |
| CO-2                                                         | Identify a suitable bearing for the given application.                                                                                    |
| CO-3                                                         | Design of gear for a given application.                                                                                                   |
| CO-4                                                         | Design of suitable I.C. engine parts for a given application.                                                                             |
| CO-5                                                         | Suggest suitable flexible elements required to transmit the desired power.                                                                |

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| <b>Course Code:</b> 19130602                             |                                                                                                        |
| <b>Course Title:</b> Industrial Engineering & Management |                                                                                                        |
| CO-1                                                     | Describe the various concepts of management techniques.                                                |
| CO-2                                                     | Identify a suitable plant location and layout by considering various industrial aspects.               |
| CO-3                                                     | Use work study concepts to improve productivity.                                                       |
| CO-4                                                     | Apply the suitable quality management techniques.                                                      |
| CO-5                                                     | Assess the project duration and crashing of any network problems.                                      |
| <b>Course Code:</b> 19130603                             |                                                                                                        |
| <b>Course Title:</b> Heat Transfer                       |                                                                                                        |
| CO-1                                                     | Explain the basic concepts of heat transfer.                                                           |
| CO-2                                                     | Solve the problems involving steady state and transient heat conduction in simple geometries.          |
| CO-3                                                     | Analyze the forced and free convective heat transfer through various systems.                          |
| CO-4                                                     | Analyze the performance of heat exchangers and evaporators using boiling and condensation principles.  |
| CO-5                                                     | Illustrate the real time applications of radiation heat transfer.                                      |
| CO-1                                                     | Explain the basic concepts of heat transfer.                                                           |
| <b>Course Code:</b> 19130604                             |                                                                                                        |
| <b>Course Title:</b> Metrology and Instrumentation       |                                                                                                        |
| CO-1                                                     | Examine the tolerances, limits and fits of engineering components.                                     |
| CO-2                                                     | Describe linear, angular measuring instruments comparators and limit gauges.                           |
| CO-3                                                     | Discuss surface roughness, gear and screw thread measurements.                                         |
| CO-4                                                     | Explain instruments for measurement of displacement, temperature, pressure, speed and flow parameters. |
| CO-5                                                     | Use instruments for measurement of stress and strain, fluid flow ,torque and power.                    |
| <b>CourseCode:</b> 19130665A                             |                                                                                                        |
| <b>Course Title:</b> Refrigeration and Air Conditioning  |                                                                                                        |
| CO-1                                                     | Describe the concepts and applications of refrigeration systems.                                       |
| CO-2                                                     | Compare & contrast the performance of vapour compression and absorption refrigeration system.          |
| CO-3                                                     | Explain steam jet refrigeration system and their components.                                           |
| CO-4                                                     | Discuss various refrigerants and components used in refrigeration plants.                              |
| CO-5                                                     | Classify air conditioning systems and assess their performance.                                        |
| <b>Course Code:</b> 19130665B                            |                                                                                                        |
| <b>Course Title:</b> Mechatronics                        |                                                                                                        |
| CO-1                                                     | Discuss the key elements of mechatronic system.                                                        |
| CO-2                                                     | Outline various sensors and actuators for an engineering application.                                  |
| CO-3                                                     | Describe various microprocessors and microcontrollers.                                                 |
| CO-4                                                     | Use appropriate microprocessor and microcontroller for interfacing sensors, actuators and other        |

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|                                                                 |                                                                                                                                             |
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|                                                                 | mechatronic elements.                                                                                                                       |
| CO-5                                                            | Construct PLC program and implementation of real life systems.                                                                              |
| <b>Course Code:19130665C</b>                                    |                                                                                                                                             |
| <b>Course Title: Advanced Foundry and Welding Technology</b>    |                                                                                                                                             |
| CO-1                                                            | Describe various moulding techniques.                                                                                                       |
| CO-2                                                            | Explain the principles of solidification and melting.                                                                                       |
| CO-3                                                            | Apply the knowledge of solid state welding process for engineering applications.                                                            |
| CO-4                                                            | Discuss the various advanced welding techniques.                                                                                            |
| CO-5                                                            | Identify the optimal welding process parameters for any welded joint.                                                                       |
| <b>Course Code:19130665D</b>                                    |                                                                                                                                             |
| <b>Course Title: Non Destructive Evaluation</b>                 |                                                                                                                                             |
| CO-1                                                            | Compare destructive testing and non destructive evaluation methods.                                                                         |
| CO-2                                                            | Discuss working principle and construction details of magnetic particle, liquid penetrant and eddy current test.                            |
| CO-3                                                            | Explain the working principle and construction details and methods of ultrasonic test.                                                      |
| CO-4                                                            | Describe the working principle and construction details and methods of radiography test.                                                    |
| CO-5                                                            | Plan the suitable NDE methods based on the required application.                                                                            |
| <b>Course Code:19131666a</b>                                    |                                                                                                                                             |
| <b>Course Title: Global Environment Problems &amp; Policies</b> |                                                                                                                                             |
| CO-1                                                            | To understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving        |
| CO-2                                                            | To reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex , interconnected world  |
| CO-3                                                            | To appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems   |
| CO-4                                                            | To know environmental laws and grasp the concept of environmental legislation and its applications in international environmental agreement |
| CO-5                                                            | To appreciate the concern of environmental agreement                                                                                        |
| <b>CourseCode:19132666a</b>                                     |                                                                                                                                             |
| <b>Course Title: Renewable Energy Resources</b>                 |                                                                                                                                             |
| CO-1                                                            | Analyze solar radiation data, extra terrestrial radiation on earths surface                                                                 |
| CO-2                                                            | Design solar thermal collections                                                                                                            |
| CO-3                                                            | Develop maximum power point techniques in solar PV and wind                                                                                 |
| CO-4                                                            | Compare solar ,wind and bio energy systems , their prospects ,advantages and limitations                                                    |
| <b>Course Code:19134666a</b>                                    |                                                                                                                                             |
| <b>Course Title: c. Data Communication</b>                      |                                                                                                                                             |
| CO-1                                                            | Understand and explain data communication system and its components                                                                         |

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| CO-2                                                    | Enumerate the layers of the OSI model and TCP/IP and explain functions of each layer                                                    |
| CO-3                                                    | Apply error detection and correction techniques to determine the error rate                                                             |
| CO-4                                                    | Identify the different types of network topologies and protocols                                                                        |
| CO-5                                                    | Familiarity with the basic wireless networks, and how they can be used to assist in network design and implementation                   |
| <b>Course Code:19135666a</b>                            |                                                                                                                                         |
| <b>Course Title: Human Computer Interaction</b>         |                                                                                                                                         |
| CO-1                                                    | Explain the capabilities of both humans and computers from the view point of human information processing                               |
| CO-2                                                    | Describe typical human computer interaction models, styles, and various historic HCI paradigms                                          |
| CO-3                                                    | Apply an interactive design process and universal design principles to designing HCI systems                                            |
| <b>Course Code:19136666a</b>                            |                                                                                                                                         |
| <b>Course Title: Remote sensing &amp; GIS in Mining</b> |                                                                                                                                         |
| CO-1                                                    | Outline the basic principles of remote sensing                                                                                          |
| CO-2                                                    | Develop the concepts of visual and digital image analysis                                                                               |
| CO-3                                                    | Summarize the basic concepts of GIS                                                                                                     |
| CO-4                                                    | Perform spatial analysis                                                                                                                |
| CO-5                                                    | Apply knowledge of remote sensing and GIS in various fields                                                                             |
| <b>Course Code:19137666a</b>                            |                                                                                                                                         |
| <b>Course Title: Modern Vehicle Technology</b>          |                                                                                                                                         |
| CO-1                                                    | Design and develop modern vehicles                                                                                                      |
| CO-2                                                    | Analyse and control the exhaust emissions and noise                                                                                     |
| CO-3                                                    | Analyse the vehicle operation and incorporate and develop the electronic control systems                                                |
| CO-4                                                    | Distinguish and choose the fuel injection system                                                                                        |
| CO-5                                                    | Classify the design analysis of injection systems                                                                                       |
| <b>Course Code:19139687</b>                             |                                                                                                                                         |
| <b>Course Title: Constitution of India</b>              |                                                                                                                                         |
| CO-1                                                    | Understand historical background of the constitution making and its importance for building a democratic india                          |
| CO-2                                                    | Understand the functioning of three wings of the government ie, executive, legislative and judiciary                                    |
| CO-3                                                    | Understand the value of the fundamental rights and duties for becoming good citizen of India                                            |
| CO-4                                                    | Analyze the decentralization of power between central, state local self government                                                      |
| CO-5                                                    | Apply the knowledge on strengthening of the constitutional institutions like CAG, election commission and upsc for sustaining democracy |

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| <b>Course Code:</b> 19130611                                 |                                                                                                                                                      |
| <b>Course Title:</b> Heat Transfer Lab                       |                                                                                                                                                      |
| CO-1                                                         | Evaluate the conduction, convection and radiation heat transfer through experiments.                                                                 |
| CO-2                                                         | Analyze the problems involving steady state and transient heat conduction in simple geometries.                                                      |
| CO-3                                                         | Evaluate heat transfer coefficients for natural convection and forced convection.                                                                    |
| CO-4                                                         | Estimate the LMTD of heat exchanger.                                                                                                                 |
| CO-5                                                         | Evaluate the Stefan Boltzmann constant and emissivity of different bodies in radiation.                                                              |
| <b>Course Code:</b> 19130612                                 |                                                                                                                                                      |
| <b>Course Title:</b> Metrology and Instrumentation Lab       |                                                                                                                                                      |
| CO-1                                                         | Measure the linear and angular dimensions of components using vernier calipers, outside micrometers, bevel protractor, sine bar and transducers etc. |
| CO-2                                                         | Assess the accuracy and errors of measuring instruments.                                                                                             |
| CO-3                                                         | Check the machine tool alignment using dial indicators and spirit level.                                                                             |
| CO-4                                                         | Calibrate instruments to measure fluid flow, temperature, speed, pressure and displacement.                                                          |
| CO-5                                                         | Investigate the vibration parameters using micrometers.                                                                                              |
| <b>Course outcomes for Fourth Year First Semester Course</b> |                                                                                                                                                      |
| <b>Course Code:</b> 19130701                                 |                                                                                                                                                      |
| <b>Course Title:</b> Finite Element Methods                  |                                                                                                                                                      |
| CO-1                                                         | Illustrate the concepts behind variation and weighted residual methods in FEM.                                                                       |
| CO-2                                                         | Analyze the applications and characteristics of finite element modelling.                                                                            |
| CO-3                                                         | Investigate element characteristic equation and generate global stiffness matrix.                                                                    |
| CO-4                                                         | Apply suitable boundary conditions to a global structural matrix equation and reduce it to solvable form.                                            |
| CO-5                                                         | Identify an appropriate FEM approach to solve problems involving dynamics and heat transfer.                                                         |
| <b>Course Code:</b> 19130702                                 |                                                                                                                                                      |
| <b>Course Title:</b> CAD/CAM                                 |                                                                                                                                                      |
| CO-1                                                         | Explain the basic concepts of CAD and Computer graphics.                                                                                             |
| CO-2                                                         | Solve the mathematical models to represent various geometries.                                                                                       |
| CO-3                                                         | Compose the part programs for engineering components.                                                                                                |
| CO-4                                                         | Explain the concepts of Group Technology and Computer Aided Quality Control.                                                                         |
| CO-5                                                         | Discuss the elements of Flexible Manufacturing Systems and Computer Integrated Manufacturing.                                                        |
| <b>Course Code:</b> 19130763A                                |                                                                                                                                                      |
| <b>Course Title:</b> Power Plant Engineering                 |                                                                                                                                                      |
| CO-1                                                         | Illustrate various power plant layouts and their working principles.                                                                                 |
| CO-2                                                         | Describe various elements involved in different power plants.                                                                                        |
| CO-3                                                         | Explain Nuclear power plants with various reactors.                                                                                                  |
| CO-4                                                         | Analyze various combined plants and find importance of measurement of pollutants.                                                                    |
| CO-5                                                         | Evaluate economic parameters and pollutants and their prevention.                                                                                    |

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**Course Code:** 19130763B

**Course Title:** Mechanical Vibrations

|      |                                                                                     |
|------|-------------------------------------------------------------------------------------|
| CO-1 | Apply the knowledge regarding various moulding techniques.                          |
| CO-2 | Explain the principles of Solidification and melting.                               |
| CO-3 | Describe the knowledge of solid state welding process for engineering applications. |
| CO-4 | Identify radiant beam welding methods.                                              |
| CO-5 | Assess the destructive and non destructive testing of welds.                        |

**Course Code:**19130763C

**Course Title:** Automobile Engineering

|      |                                                                           |
|------|---------------------------------------------------------------------------|
| CO-1 | Describe various functional components of an Automobile.                  |
| CO-2 | Explain engine auxiliary systems used in SI and CI engine.                |
| CO-3 | Examine ignition and electrical systems in Automobiles.                   |
| CO-4 | Compare manual transmissions systems with automatic transmission systems. |
| CO-5 | Illustrate the working of steering, braking and the suspension systems.   |

**Course Code:**19130763D

**Course Title:** Advanced Machining Processes

|      |                                                                                                   |
|------|---------------------------------------------------------------------------------------------------|
| CO-1 | Select suitable surface treatment technique for any given application.                            |
| CO-2 | Describe working principles of mechanical energy based non traditional machining processes.       |
| CO-3 | Discuss different electro chemical and discharge machining processes and also their applications. |
| CO-4 | Describe working principles and applications of IBM, LBM, EBM and PAM.                            |
| CO-5 | Explain various manufacturing techniques of powder metallurgy.                                    |

**Course Code:**19130764A

**Course Title:** Gas Dynamics & Jet Propulsions

|      |                                                                                        |
|------|----------------------------------------------------------------------------------------|
| CO-1 | Solve basic problems of thermodynamics and fluid mechanics.                            |
| CO-2 | Solve fluid flow problems through ducts with and without heat flow including friction. |
| CO-3 | Analyze the change in flow properties across shock waves in different flow regions.    |
| CO-4 | Examine performance of jet propulsion engines.                                         |
| CO-5 | Find the performance of Rocket engines using principles of gas dynamics.               |

**Course Code:**19130764B

**Course Title:** Micro Electro Mechanical Systems

|      |                                                                          |
|------|--------------------------------------------------------------------------|
| CO-1 | Describe the working principles of micro-sensors and actuators.          |
| CO-2 | Explain the application of scaling laws in the design of micro systems.  |
| CO-3 | Identify the typical materials used for fabrication of micro systems.    |
| CO-4 | Discuss the principles of standard micro fabrication techniques.         |
| CO-5 | Analyze various micro electro mechanical systems and their construction. |

**Course Code:**19130764C

**Course Title:** Design for Manufacturing

|      |                                                                   |
|------|-------------------------------------------------------------------|
| CO-1 | Explain the design philosophy and manufacturability of a product. |
|------|-------------------------------------------------------------------|

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|                                                                  |                                                                                                                                   |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| CO-2                                                             | Investigate machining and casting processes from design perspective.                                                              |
| CO-3                                                             | Identify the design principle sin extrusion, sheet metal and welding.                                                             |
| CO-4                                                             | Infer design aspects in forging and manufacturing of plastics.                                                                    |
| CO-5                                                             | Summarize the design considerations in manual and automatic assembly process.                                                     |
| <b>Course Code:</b> 19130764D                                    |                                                                                                                                   |
| <b>Course Title:</b> . Automation in Manufacturing               |                                                                                                                                   |
| CO-1                                                             | Discuss the different fundamental concepts of automation and its tools.                                                           |
| CO-2                                                             | Analyze the automated flow lines & line balancing methods.                                                                        |
| CO-3                                                             | Classify the automated material handling, automated storage and retrieval systems in industries.                                  |
| CO-4                                                             | Explain the working of adaptive control systems for temperature, vibration, forces etc.                                           |
| CO-5                                                             | Describe various automated inspection methods.                                                                                    |
| <b>Course Code:</b> 19139765a                                    |                                                                                                                                   |
| <b>Course Title:</b> Managerial Economics and Financial Analysis |                                                                                                                                   |
| CO-1                                                             | Analyze the scope of managerial economics                                                                                         |
| CO-2                                                             | Analyse various aspects of managerial economics production ,cost analysis , markets and pricing strategies                        |
| CO-3                                                             | Develop an ability to identify formulate and solve engineering problems by applying the subject knowledge of managerial economics |
| CO-4                                                             | Apply capital budgeting financial analysis techniques in evaluating various investments opportunities                             |
| CO-5                                                             | Enhance their capabilities in the interpretation of balance sheets are followed in industries                                     |
| <b>Course Code:</b> 19139765b                                    |                                                                                                                                   |
| <b>Course Title:</b> . Entrepreneurship Qualities for Engineers  |                                                                                                                                   |
| CO-1                                                             | Can know the importance of entrepreneurship in economic developments, ethics and its social responsibilities                      |
| CO-2                                                             | Can understand the business plan its scope implementation in marketing                                                            |
| CO-3                                                             | Can able to know the finance resources motivation marketing and internet advertising                                              |
| CO-4                                                             | Can understand the problems related to selection of layout                                                                        |
| CO-5                                                             | Can know the production techniques, inventory and quality control in global aspects                                               |
| <b>Course Code:</b> 19139765c                                    |                                                                                                                                   |
| <b>Course Title:</b> Principles of Management                    |                                                                                                                                   |
| CO-1                                                             | Gain the knowledge of basic concepts tested principles emerging ideas, evolving theories and latest techniques                    |
| CO-2                                                             | Understand the importance of critical decisions that ensure growth and sustainability of the organization                         |
| CO-3                                                             | Understand theoretical aspects and its application to modern management practice                                                  |
| CO-4                                                             | Demonstrate critical thinking when presented with managerial issues and problems                                                  |
| CO-5                                                             | Understand the importance of professional management for effective utilization of resources in organizations                      |

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**CourseCode:**19139765d

**Course Title:** Financial Management for Engineers

|      |                                                                                                                                                                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | The students would be able to understand and define Basic terminology used in finance and accounts                                                                                                                                                                       |
| CO-2 | The students would be able to prepare& appraise Financial Statements and evaluate a company in the light of different measurement systems                                                                                                                                |
| CO-3 | The students would be able to analyse the risk and return of alternative sources of financing.                                                                                                                                                                           |
| CO-4 | Estimate cash flows from a project, including operating, net working capital, and capital spending.                                                                                                                                                                      |
| CO-5 | To estimate the required return on projects of differing risk. to estimate the cash flows from an investment project. calculate the appropriate discount rate, and determine the value added from the project, and make a recommendation to accept or reject the project |

**Course Code:**19139765e

**Course Title:** Operations management

|      |                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------|
| CO-1 | Are able to understand the basic concepts in operations and production activities                      |
| CO-2 | Can identify the factors influencing plant location and plant layout                                   |
| CO-3 | Can identify the production process and execute the customer order timely                              |
| CO-4 | Can manage the materials manpower effectively by using appropriate inventory and time study techniques |
| CO-5 | Can improve the productivity by using effective quality control standards and techniques               |

**Course Code:**19139765f

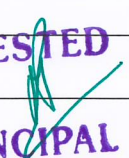
**Course Title:** Digital Marketing

|      |                                                                                |
|------|--------------------------------------------------------------------------------|
| CO-1 | Would be able to learn about model approach of marketing                       |
| CO-2 | Would be able to learn various methods and channels of digital marketing       |
| CO-3 | Would be introduced to digital marketing planning execution                    |
| CO-4 | Get concepts of sees introduced for the benefit of students aspiring start-ups |
| CO-5 | Can learn advertising strategies of digital marketing have been introduced     |

**Course Code:**19139765g

**Course Title:** Total Quality Management

|      |                                                                                                                                                            |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | To realize the importance of significance of quality                                                                                                       |
| CO-2 | Manage quality improvement teams                                                                                                                           |
| CO-3 | Identify requirements of quality improvement programs                                                                                                      |
| CO-4 | Develop a thinking towards quality systems and thinking                                                                                                    |
| CO-5 | Acknowledge the strategic value of leading practices and therefore their implementation efficiently designing the effective performance measurement system |

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**Course Code:**19139765h

**Course Title:** Organizational Behaviour

|      |                                                           |
|------|-----------------------------------------------------------|
| CO-1 | Understand the basic concepts in organizational behaviour |
|------|-----------------------------------------------------------|



|                                                               |                                                                                                                                                   |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-2                                                          | Protect the cause and effect relationship of the people in a work place                                                                           |
| CO-3                                                          | Understand the group behaviour and its impact on work performance and organization                                                                |
| CO-4                                                          | Understand the managerial strategies in achieving the goals of organizations                                                                      |
| CO-5                                                          | Improve the results-performance outcome through human behaviour and organizational behaviour can aid them in their pursuit of the goals           |
| <b>Course Code:19139765i</b>                                  |                                                                                                                                                   |
| <b>Course Title: Human Resource Management</b>                |                                                                                                                                                   |
| CO-1                                                          | Integrated perspective on role of hr in modern business. Ability to plan human resources and implement techniques of job design                   |
| CO-2                                                          | Can conduct job analysis and scientific recruitment and selection process for the higher productivity                                             |
| CO-3                                                          | Can get competency to recruit train and appraise the performance of employees                                                                     |
| CO-4                                                          | Can learn rational design of compensation and salary administration                                                                               |
| CO-5                                                          | Are able to handle employee issues and evaluate the new trends in hr                                                                              |
| <b>Course Code:19139786</b>                                   |                                                                                                                                                   |
| <b>Course Title: Intellectual Property Rights and Patents</b> |                                                                                                                                                   |
| CO-1                                                          | To understand the concepts of intellectual property rights                                                                                        |
| CO-2                                                          | Develops procedural knowledge to Legal System and solving the problem relating to intellectual property rights.                                   |
| CO-3                                                          | Skill to pursue the professional programs in Company Secretary ship, Law, Business International Affairs, Public Administration and Other fields. |
| CO-4                                                          | Employability as the Compliance Officer, Public Relation Officer and Liaison Officer.                                                             |
| CO-5                                                          | Establishment of Legal Consultancy and service provider. cyber crime                                                                              |
| <b>Course Code:19130711</b>                                   |                                                                                                                                                   |
| <b>Course Title: CAD/CAM Lab</b>                              |                                                                                                                                                   |
| CO-1                                                          | Analyze various types of 2D and 3D trusses by static and dynamic analysis using ANSYS.                                                            |
| CO-2                                                          | Solve the static problems involving corner bracket and cylinder components.                                                                       |
| CO-3                                                          | Examine the beams with various end conditions subjected to static load.                                                                           |
| CO-4                                                          | Analyze various thermal properties of bodies with different geometries.                                                                           |
| CO-5                                                          | Compose NC code for turning and pocket milling operations.                                                                                        |
| <b>Course outcomes for Fourth Year second Semester Course</b> |                                                                                                                                                   |
| <b>Course Code:19139801</b>                                   |                                                                                                                                                   |
| <b>Course Title: Operations Research</b>                      |                                                                                                                                                   |
| CO-1                                                          | Describe the various operations research models and their applications.                                                                           |
| CO-2                                                          | Solve the various engineering and managerial problems of LPP, transportation, assignment, sequencing and replacement.                             |
| CO-3                                                          | Apply game theory in different competitive situations.                                                                                            |
| CO-4                                                          | Solve the problems related to theories of waiting line and inventory models                                                                       |
| CO-5                                                          | Apply the principles of dynamic programming and simulation framework to solve various decision making situations.                                 |

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|                                                      |                                                                                                                  |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Course Code:</b> 19130862A                        |                                                                                                                  |
| <b>Course Title:</b> Computational Fluid Dynamics    |                                                                                                                  |
| CO-1                                                 | Identify different application of CFD.                                                                           |
| CO-2                                                 | Analyze governing equations of fluid dynamics using CFD.                                                         |
| CO-3                                                 | Examine the behaviour of hyperbolic, parabolic and elliptic equations by using explicit and implicit approaches. |
| CO-4                                                 | Evaluate the transformed governing equations using boundary conditions.                                          |
| CO-5                                                 | Asses the linear 3D FVD schemes in fluid flow problems.                                                          |
| <b>Course Code:</b> 19130862B                        |                                                                                                                  |
| <b>Course Title:</b> B. Nano Technology              |                                                                                                                  |
| CO-1                                                 | Discuss the applications of nano materials in engineering and few other fields.                                  |
| CO-2                                                 | Describe the mechanical, electrical, thermal and physical properties of nano materials.                          |
| CO-3                                                 | Explain the synthesis and fabrication techniques of nano particles.                                              |
| CO-4                                                 | Discuss the uses of characterization techniques such as spectroscopy, SEM, TEM and XRD.                          |
| CO-5                                                 | Describe carbon nano technology and its various applications.                                                    |
| <b>Course Code:</b> 19130862C                        |                                                                                                                  |
| <b>Course Title:</b> Additive Manufacturing          |                                                                                                                  |
| CO-1                                                 | Discuss the applications of nano materials in engineering and few other fields.                                  |
| CO-2                                                 | Describe the mechanical, electrical, thermal and physical properties of nano materials.                          |
| CO-3                                                 | Explain the synthesis and fabrication techniques of nano particles.                                              |
| CO-4                                                 | Discuss the uses of characterization techniques such as spectroscopy, SEM, TEM and XRD.                          |
| CO-5                                                 | Describe carbon nano technology and its various applications.                                                    |
| <b>Course Code:</b> 19130862D                        |                                                                                                                  |
| <b>Course Title:</b> Production Planning and Control |                                                                                                                  |
| CO-1                                                 | Explain the elements of production planning and control.                                                         |
| CO-2                                                 | Investigate various forecasting techniques for manufacturing and service sectors.                                |
| CO-3                                                 | Use the appropriate inventory model for various industrial circumstances.                                        |
| CO-4                                                 | Create the optimized route and schedule for the product to achieve the desired objectives.                       |
| CO-5                                                 | Discuss the dispatch and control activities for production process, and factory physics.                         |
| <b>Course Code:</b> 19130841                         |                                                                                                                  |
| <b>Course Title:</b> Project Work                    |                                                                                                                  |
| CO-1                                                 | Research relevant and reliable literature to evaluate the state of the field.                                    |
| CO-2                                                 | Undertake problem identification, formulation and solution.                                                      |
| CO-3                                                 | To allow students to develop problem solving, analysis, synthesis and evaluation skills.                         |
| CO-4                                                 | Deliver presentations that are required as engineers.                                                            |

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**GR-19 B.Tech Electronics & Communication Engineering**

**B.TECH-ELECTRONICS and COMMUNICATION SENGINEERING**

**Department Vision :**

Create an educational environment to mound the students to meet the challenges of modern Electronics & Communication industry through state of the art Technical knowledge and Innovative experimental Approaches.

**Department Mission:**

1. To create learning, development and testing environment to meet ever challenging needs of the Electronic industry
2. To create entrepreneurial environment and industry interaction for mutual benefit
3. To become a global partner in training human resources in the fields of chip design, instrumentation and networking
4. To associate with internationally reputed Institutions for Academic excellence and collaborative Research

**Program Educational Objectives(PEOs) :**

|             |                                                                                                                                                                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PEO1</b> | To prepare students with excellent comprehension of basic Sciences, mathematics and engineering subjects facilitating them to gain employment or pursue postgraduate studies with an appreciation for lifelong learning.                                                                              |
| <b>PEO2</b> | To train students with problem solving capabilities such as analysis and design with adequate practical skills wherein they demonstrate creativity and innovation that would enable them to develop state of the art equipment and technologies of multidisciplinary nature for societal development. |

**Program Specific Outcomes(PSO's):**

|             |                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b> | Analyze and design analog and digital circuits or systems for a given specification and function.                 |
| <b>PSO2</b> | Implement functional blocks of hardware-software co-designs for signal processing and communication applications. |

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**Program Outcomes (POs): Engineering Graduates will be able to:**

|    |                                                                                                                                                                                                                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | <b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.                                                                                                                  |
| 2  | <b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.                                                                 |
| 3  | <b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.         |
| 4  | <b>Conduct investigation of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.                                                                 |
| 5  | <b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.                                                                 |
| 6  | <b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.                                                               |
| 7  | <b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.                                                                                   |
| 8  | <b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.                                                                                                                                                                    |
| 9  | <b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.                                                                                                                                                  |
| 10 | <b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| 11 | <b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply them to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.                                               |
| 12 | <b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.                                                                                                                 |

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**Course out comes (Cos) of all courses of all programs offered by the institution**

| <b>Course Out comes for First Year First Semester Course</b> |                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CourseCode:19199101</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title :Mathematics-I</b>                           |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | Transform the knowledge of solving system of linear equations using matrices.                                                                                                                                                                                                                                                                                |
| <b>CO-2</b>                                                  | Apply mean value Rolls, Lagranges and Cauchy mean value theorem in engineering applications.                                                                                                                                                                                                                                                                 |
| <b>CO-3</b>                                                  | Acquire the knowledge maxima and minima of function of several variables                                                                                                                                                                                                                                                                                     |
| <b>CO-4</b>                                                  | Evaluate multiple integrals and their applications                                                                                                                                                                                                                                                                                                           |
| <b>CourseCode:19199102</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title :Communicative English-I</b>                 |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | students will be able to develop effective reading strategies                                                                                                                                                                                                                                                                                                |
| <b>CO-2</b>                                                  | will be able to demonstrate writing skills that are required for professional development and use graphic elements for communication                                                                                                                                                                                                                         |
| <b>CO-3</b>                                                  | will be able to apply grammatical skills and vocabulary effectively in speech and writing                                                                                                                                                                                                                                                                    |
| <b>Course code:19199103</b>                                  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Engineering Physics</b>                     |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | To impart knowledge of physical optical phenomenon like Interference, Diffraction and polarization involving design of optical instruments with higher resolution To explain the concept of dielectric constant and polarization in dielectric materials and summarize Gauss's law in the presence of dielectrics.                                           |
| <b>CO-2</b>                                                  | To interpret dielectric loss, Lorentz field and Claussius- Mosotti relation and classify the magnetic materials based on susceptibility and their temperature dependence .To apply the Gauss' Theorem for divergence and Stokes' Theorem for curl and evaluate Maxwell's displacement current and correction in Ampere's law                                 |
| <b>CO-3</b>                                                  | To assess the electromagnetic wave propagation in different media and its power and explain the working principle of optical fibers and its classification based on refractive index profile and mode of propagation with their applications. To classify the energy bands of semiconductors and outline the properties of n-type and p-type semiconductors. |
| <b>CO-4</b>                                                  | To study the basic Quantum mechanics, interpretation of the direct and indirect band gap in semiconductors and identify the type of semiconductor using Hall effect.                                                                                                                                                                                         |
| <b>Course code:19199104</b>                                  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Title: Problem Solving &amp; Programming in C</b>  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | Obtain the knowledge about different languages used in computer programming and basic terminology used in the computer programming.                                                                                                                                                                                                                          |
| <b>CO-2</b>                                                  | Write algorithm, flow chart, and structure of C program and make use of different C tokens inside C program.                                                                                                                                                                                                                                                 |
| <b>CO-3</b>                                                  | Develop program by using Control structure, different looping and Jump statement.                                                                                                                                                                                                                                                                            |
| <b>CO-4</b>                                                  | Implement applications of Array, Structure and String inside the program. Also acquire the knowledge of different FILE operations.                                                                                                                                                                                                                           |
| <b>Coursecode:19193175</b>                                   |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CourseTitle:Engineering Graphics</b>                      |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | CO1: Apply principles of drawing to represent dimensions of an object                                                                                                                                                                                                                                                                                        |
| <b>CO-2</b>                                                  | Outline the polygons and engineering curves                                                                                                                                                                                                                                                                                                                  |
| <b>CO-3</b>                                                  | Illustrate projections of point, lines planes and solids                                                                                                                                                                                                                                                                                                     |
| <b>CO-4</b>                                                  | Illustrate 3D views though isometric views                                                                                                                                                                                                                                                                                                                   |
| <b>CO-5</b>                                                  | Create the isometric views and orthographic views                                                                                                                                                                                                                                                                                                            |
| <b>Course code:19199112</b>                                  |                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Name: Engineering Physics Laboratory</b>           |                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-1</b>                                                  | To handle optical instruments like microscope and spectrometer, determine thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colors using diffraction grating.                                                                                                                       |

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| <b>CO-2</b>                                            | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance |
| <b>Course code:19199111</b>                            |                                                                                                                                                                                                                 |
| <b>Course Name: Communicative English Laboratory-I</b> |                                                                                                                                                                                                                 |
| <b>CO-1</b>                                            | Learning to communicate in English.                                                                                                                                                                             |
| <b>CO-2</b>                                            | Comprehend native speakers accent.                                                                                                                                                                              |

| Course Outcomes for First Year Second Semester Course               |                                                                                                             |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Course Code:19199201a</b>                                        |                                                                                                             |
| <b>Course Title: Mathematics-II</b>                                 |                                                                                                             |
| <b>CO-1</b>                                                         | Apply the knowledge of descriptive statistics and method of data science in practical engineering problems. |
| <b>CO-2</b>                                                         | Apply the Knowledge of Probability in practical Engineering problems                                        |
| <b>CO-3</b>                                                         | Demonstrate the knowledge of Probability distributions.                                                     |
| <b>CO-4</b>                                                         | Enhance knowledge in Sampling & Estimation techniques.                                                      |
| <b>CO-5</b>                                                         | Enhance Knowledge in Design of Experiments.                                                                 |
| <b>Course Code:19199202</b>                                         |                                                                                                             |
| <b>Course Title: Communicative English-II</b>                       |                                                                                                             |
| <b>CO-1</b>                                                         | Paraphrase short academic texts using suitable strategies and conventions                                   |
| <b>CO-2</b>                                                         | Make formal structured presentations on academic topics using PPT slides with relevant graphical elements   |
| <b>CO-3</b>                                                         | Build the ability to convey in different communicative forms.                                               |
| <b>Course code:19199203</b>                                         |                                                                                                             |
| <b>Course Title: Applied Chemistry</b>                              |                                                                                                             |
| <b>CO-1</b>                                                         | Compare different types of cells                                                                            |
| <b>CO-2</b>                                                         | Explain the merits of fuel cells                                                                            |
| <b>CO-3</b>                                                         | List various sources of renewable energy                                                                    |
| <b>CO-4</b>                                                         | Distinguish between polymers and plastics                                                                   |
| <b>CO-5</b>                                                         | Distinguish between nano clusters & nano wires, polymers                                                    |
| <b>Course code:19192204</b>                                         |                                                                                                             |
| <b>Course Title: Basic Electrical &amp; Electronics Engineering</b> |                                                                                                             |
| <b>CO-1</b>                                                         | Analyze the various electrical networks                                                                     |
| <b>CO-2</b>                                                         | Understand the operation of DC machines, 3-point starter and conduct the Swinburne's Test.                  |
| <b>CO-3</b>                                                         | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.       |
| <b>CO-4</b>                                                         | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                          |
| Course Outcomes for Second Year first Semester Course               |                                                                                                             |
| <b>Course Code:19142302</b>                                         |                                                                                                             |
| <b>Course Title :Network Analysis</b>                               |                                                                                                             |
| <b>CO-1</b>                                                         | Analyze network, network topology and various network reduction techniques                                  |
| <b>CO-2</b>                                                         | Understand AC fundamentals, steady-state analysis of AC circuits, magnetic circuits and resonance concept.  |
| <b>CO-3</b>                                                         | Apply network theorems to both DC and AC networks and know about various two port network                   |

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|                                                               | parameters.                                                                                                                                        |
| <b>Course Code:19140303</b>                                   |                                                                                                                                                    |
| <b>Course Title: Electronic Devices &amp; Circuits</b>        |                                                                                                                                                    |
| <b>CO-1</b>                                                   | Apply the Knowledge of semiconductor physics for designing the circuits of electronic devices.                                                     |
| <b>CO-2</b>                                                   | Obtain the characteristics of diode in forward and reverse bias and perform Mathematical modeling of diode as a resistor and capacitor.            |
| <b>CO-3</b>                                                   | Perform analysis and design of a complete AC to DC converter consisting of rectifiers, filters and regulators.                                     |
| <b>CO-4</b>                                                   | Describe the construction and working of a transistor in various modes and design circuits for stabilization and compensation of both BJT and FET. |
| <b>CO-5</b>                                                   | Gain knowledge of small signal low frequency transistor amplifier models.                                                                          |
| <b>Course code:19140304</b>                                   |                                                                                                                                                    |
| <b>Course Title: Switching Theory &amp; Logic Design</b>      |                                                                                                                                                    |
| <b>CO-1</b>                                                   | Represent numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.               |
| <b>CO-2</b>                                                   | Realize Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.                          |
| <b>CO-3</b>                                                   | Design and analyze combinational circuits and to use standard combinational functions/building blocks to build complex circuits.                   |
| <b>CO-4</b>                                                   | Design and analyze sequential circuits and devices and to use standard sequential functions/building blocks to build complex circuits.             |
| <b>CO-5</b>                                                   | Design and analyze finite state machine.                                                                                                           |
| <b>Course code: 19140305</b>                                  |                                                                                                                                                    |
| <b>Course Title: Signals and Systems</b>                      |                                                                                                                                                    |
| <b>CO-1</b>                                                   | Characterize and analyze the properties of CT and DT signals that are commonly used in engineering applications.                                   |
| <b>CO-2</b>                                                   | Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis                                      |
| <b>CO-3</b>                                                   | Classify systems based on their properties and determine the response of LTI system using convolution                                              |
| <b>CO-4</b>                                                   | Understand the process of sampling and the effects of under sampling.                                                                              |
| <b>CO-5</b>                                                   | Apply the Laplace transform and Z-transform to analyze continuous-time and discrete-time signals and systems.                                      |
| <b>Course Outcomes for Second Year Second Semester Course</b> |                                                                                                                                                    |
| <b>CourseCode:19140403</b>                                    |                                                                                                                                                    |
| <b>Course Title: Electronic Circuit Analysis</b>              |                                                                                                                                                    |
| <b>CO-1</b>                                                   | Perform analysis and design of Small Signal Transistor Amplifier models.                                                                           |
| <b>CO-2</b>                                                   | Perform analysis of high frequency response of BJT and FET.                                                                                        |
| <b>CO-3</b>                                                   | Demonstrate the knowledge of multistage amplifier and differential amplifier using BJT                                                             |
| <b>CO-4</b>                                                   | Analyze the concepts of both positive and negative feedback in electronic circuits and to generate signals in various frequency ranges.            |
| <b>CO-5</b>                                                   | Design different types of power amplifiers for real time applications                                                                              |
| <b>Course Code:19140404</b>                                   |                                                                                                                                                    |
| <b>Course Title: Analog Communications</b>                    |                                                                                                                                                    |
| <b>CO-1</b>                                                   | Relate modulation, demodulation techniques and understand major building blocks of communication systems.                                          |

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| CO-2                                                        | Understand the communication systems and distinguish between different modulation techniques.                                                            |
| CO-3                                                        | Analyze generation and detection of FM signals in both time domain and frequency domains and Learn about less noise immune systems..                     |
| CO-4                                                        | Sample analog signals and understand multiplexing of signals.                                                                                            |
| CO-5                                                        | develop a clear insight into the relations between the input and output AC signals in various stages of a transmitter and receiver of AM and FM systems. |
| <b>Course code:19140411</b>                                 |                                                                                                                                                          |
| <b>Course Title: Electronic Circuit Analysis Lab</b>        |                                                                                                                                                          |
| CO-1                                                        | Perform analysis and design of Small Signal Transistor Amplifier models.                                                                                 |
| CO-2                                                        | Design and analysis of feedback amplifiers and oscillators                                                                                               |
| CO-3                                                        | Demonstrate the knowledge of multistage amplifier and differential amplifier using BJT.                                                                  |
| CO-4                                                        | Design and analysis of different types of power amplifiers                                                                                               |
| CO-5                                                        | Design different types of tuned amplifiers for real time applications                                                                                    |
| <b>Course code:19140413</b>                                 |                                                                                                                                                          |
| <b>Course Title: Analog Communication Lab</b>               |                                                                                                                                                          |
| CO-1                                                        | Identify and describe different Amplitude modulation techniques                                                                                          |
| CO-2                                                        | Identify and applying Emphasis techniques in analog systems                                                                                              |
| CO-3                                                        | Sample analog signals                                                                                                                                    |
| CO-4                                                        | Analyze different discrete pulse modulation techniques Analyze different discrete pulse modulation techniques                                            |
| CO-5                                                        | Understand and Simulate the different codes using MATLAB                                                                                                 |
| <b>Course Outcomes for Third Year First Semester Course</b> |                                                                                                                                                          |
| <b>Course Code:19140503</b>                                 |                                                                                                                                                          |
| <b>Course Title: Linear &amp; Digital IC Applications</b>   |                                                                                                                                                          |
| CO-1                                                        | Understand the internal operation of Op-Amp and its specifications.                                                                                      |
| CO-2                                                        | Analyze and design linear and nonlinear applications using Op-Amp.                                                                                       |
| CO-3                                                        | Operate 555 timers in different modes like be stable, monostable and as table operations and study their applications.                                   |
| CO-4                                                        | Understand the conversion process of ADC and DAC in digital electronics.                                                                                 |
| CO-5                                                        | Explain the differences between CMOS and TTL logic families and study various digital ICs.                                                               |
| <b>Course Code: 19140504</b>                                |                                                                                                                                                          |
| <b>Course Title: Digital Communication</b>                  |                                                                                                                                                          |
| CO-1                                                        | Explain the conventional digital communication system.                                                                                                   |
| CO-2                                                        | Discuss the pulse digital modulation schemes such as PCM, DPCM and DM.                                                                                   |
| CO-3                                                        | Evaluate the performance of various digital modulation techniques in terms of probability of error                                                       |
| CO-4                                                        | Analyze the performance of digital communication system in the presence of noise                                                                         |
| CO-5                                                        | Compute and analyze block codes, cyclic codes and convolution codes.                                                                                     |
| <b>Course code: 19140505</b>                                |                                                                                                                                                          |
| <b>Course Title: Antenna and Wave Propagation</b>           |                                                                                                                                                          |
| CO-1                                                        | Acquire knowledge of basic antenna parameters.                                                                                                           |

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| CO-2                                                         | Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas, and micro-strip antennas.                          |
| CO-3                                                         | Analyze the fields radiated by various types of antennas.                                                                                             |
| CO-4                                                         | Analyze antenna arrays.                                                                                                                               |
| CO-5                                                         | Analyze antenna measurements to assess antenna's performance.                                                                                         |
| <b>Course code:19140511</b>                                  |                                                                                                                                                       |
| <b>Course Title: Linear IC Applications Laboratory</b>       |                                                                                                                                                       |
| CO-1                                                         | Design and implementation of Filter circuits using IC 7                                                                                               |
| CO-2                                                         | Analyze the functionality of Multi vibrator circuits using IC 555                                                                                     |
| CO-3                                                         | Work in teams to design amplifier circuits using IC 741                                                                                               |
| CO-4                                                         | Design and analyze A/D and D/A converters                                                                                                             |
| CO-5                                                         | Design and perform voltage regulation using IC 723                                                                                                    |
| <b>Course Outcomes for Third Year Second Semester Course</b> |                                                                                                                                                       |
| <b>Course Code:19144602</b>                                  |                                                                                                                                                       |
| <b>Course Title: Computer Networks</b>                       |                                                                                                                                                       |
| CO-1                                                         | Understand the fundamental principles of computer networks and various reference models                                                               |
| CO-2                                                         | Identify the different types of network topologies and protocols.                                                                                     |
| CO-3                                                         | Understand and explain Data Communications System and its components.                                                                                 |
| CO-4                                                         | Understand and building the skills of sub netting and routing mechanisms.                                                                             |
| CO-5                                                         | Identify the different types of network devices and their functions within a network                                                                  |
| <b>Course Code: 19144603</b>                                 |                                                                                                                                                       |
| <b>Course Title: Microprocessors and Microcontrollers</b>    |                                                                                                                                                       |
| CO-1                                                         | Learn architectural difference between Microprocessor and Microcontroller and its need for development of products and product development procedure. |
| CO-2                                                         | Learn of RAM and ROM memory interfacing concepts and address calculations                                                                             |
| CO-3                                                         | Apply concepts of programming in Assembly Language and Embedded C programming                                                                         |
| CO-4                                                         | Analyze the concepts of Input / Output port Interfacing of microcontroller.                                                                           |
| CO-5                                                         | Apply concepts of serial and parallel communication methods to various sensors                                                                        |
| <b>Course code:19144604</b>                                  |                                                                                                                                                       |
| <b>Course Title: Digital Signal Processing</b>               |                                                                                                                                                       |
| CO-1                                                         | Interpret, represent and process discrete/digital signals and systems.                                                                                |
| CO-2                                                         | Understand frequency domain analysis of discrete time signals and systems using DTFT, DFT and FFT.                                                    |
| CO-3                                                         | Design and implement FIR and IIR filters using different methods, and how to test, analyze and refine design.                                         |
| CO-4                                                         | Realize the basic structures of FIR and IIR systems.                                                                                                  |
| CO-5                                                         | Acquire the basics of multi rate digital signal processing.                                                                                           |
| <b>Course Outcomes for Fourth Year First Semester Course</b> |                                                                                                                                                       |
| <b>Course Code:19140702</b>                                  |                                                                                                                                                       |
| <b>Course Title: VLSI Design</b>                             |                                                                                                                                                       |
| CO-1                                                         | Analyze the fabrication process of CMOS digital circuits.                                                                                             |

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| CO-2                                                                            | Apply the concept of design rules during the layout of a circuit.                                                                             |
| CO-3                                                                            | Analyze the architectural issues of subsystem design.                                                                                         |
| CO-4                                                                            | Implement circuit through various design styles (Semi-Custom, Full Custom).                                                                   |
| CO-5                                                                            | Apply the clock mechanism, demonstrate the architectural of FPGA.                                                                             |
| <b>Course Code: 19140703</b>                                                    |                                                                                                                                               |
| <b>Course Title: Optical Communication</b>                                      |                                                                                                                                               |
| CO-1                                                                            | Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.     |
| CO-2                                                                            | Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers                             |
| CO-3                                                                            | Describe the principles of optical sources and power launching-coupling methods                                                               |
| CO-4                                                                            | Compare the characteristics of fiber optic receivers                                                                                          |
| CO-5                                                                            | Design a fiber optic link based on budget and choose necessary components required in modern optical communication systems.                   |
| <b>Course code: 19140706B</b>                                                   |                                                                                                                                               |
| <b>Course Title: Embedded System Design</b>                                     |                                                                                                                                               |
| CO-1                                                                            | Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems. |
| CO-2                                                                            | Understand different I/O devices and peripherals used in embedded networking.                                                                 |
| CO-3                                                                            | Develop programming skills in embedded systems for various applications.                                                                      |
| CO-4                                                                            | Choose and operating system, and learn how to choose an RTOS.                                                                                 |
| CO-5                                                                            | Acquire knowledge about Life cycle of embedded design and its testing.                                                                        |
| <b>CourseCode:19140706D</b>                                                     |                                                                                                                                               |
| <b>Course Title: Wireless Sensor Networks</b>                                   |                                                                                                                                               |
| CO-1                                                                            | Identify major issues and challenges associated with wireless sensor networks.                                                                |
| CO-2                                                                            | Identify the requirement of protocols for wireless ad-hoc networks as compared to the existing aired network.                                 |
| CO-3                                                                            | Explore network layer technologies by researching key areas such as algorithms, protocols, hardware, and applications.                        |
| CO-4                                                                            | Discuss the concepts of transport layer protocols for wireless ad-hoc networks.                                                               |
| CO-5                                                                            | Understand security requirements, Issues and Challenges involved in wireless ad-hoc networks.                                                 |
| <b>Course Code:19140711</b>                                                     |                                                                                                                                               |
| <b>Course Title: Microwave Engineering and Optical Communication Laboratory</b> |                                                                                                                                               |
| CO-1                                                                            | Analyze the working of several microwave components                                                                                           |
| CO-2                                                                            | Perform measurements with the microwave equipment                                                                                             |
| CO-3                                                                            | Measure several waveguides, antenna related parameters and analyze the performance characteristics                                            |
| <b>Course Outcomes for Fourth Year Second Semester Course</b>                   |                                                                                                                                               |
| <b>Course Code:19140802A</b>                                                    |                                                                                                                                               |
| <b>Course Title: Radar System Engineering</b>                                   |                                                                                                                                               |
| CO-1                                                                            | Acquire the knowledge to apply and design required parameters for RADAR system.                                                               |
| CO-2                                                                            | Analyze the working principle of CW and Frequency Modulated Radar                                                                             |
| CO-3                                                                            | Analyze the working principle of MTI and pulse Doppler Radar                                                                                  |

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| <b>CO-4</b>                            | Acquire the knowledge of different types of radars and radar trackers          |
| <b>CO-5</b>                            | Acquire the knowledge about different types of radar receivers                 |
| <b>Course Code:19140801C</b>           |                                                                                |
| <b>Course Title: Digital IC Design</b> |                                                                                |
| <b>CO-1</b>                            | Describe the concepts of MOS Devices and modeling.                             |
| <b>CO-2</b>                            | Design and analyze any Analog Circuits in real time applications               |
| <b>CO-3</b>                            | Extend the analog circuit design to different applications in real time.       |
| <b>CO-4</b>                            | Analyze of Open-loop comparators and different types of oscillators            |
| <b>CO-5</b>                            | Design and analyze PLL ,Ring Oscillators and other Oscillators                 |
| <b>Course Code: 1914084161</b>         |                                                                                |
| <b>Course Title: Project</b>           |                                                                                |
| <b>CO-1</b>                            | Apply all levels of Engineering knowledge in solving the engineering problems. |
| <b>CO-2</b>                            | Work together with team spirit.                                                |
| <b>CO-3</b>                            | Use civil engineering software atleast once                                    |
| <b>CO-4</b>                            | Document the projects.                                                         |

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## GR-19 B.Tech Computer Science & Engineering

### B. TECH – COMPUTER SCIENCE & ENGINEERING

#### Department Vision:

To be a center of academic excellence in the field of computer science and engineering education and research, to serve as a valuable resource for industry and society, maintaining the traditions and human values.

#### Department Mission:

M1: Providing the best educational facilities for training students for the careers in science and technology.

M2: Providing a creative atmosphere in which higher studies and research thrive both among the students and the faculty.

M3: Undertaking collaborative projects which offer opportunities for long-term interaction with academia and industry.

M4: Sensitization towards importance for ethical practice, societal responsibility, leadership, entrepreneurship, communication and lifelong learning.

#### Program Educational Objectives (PEOs):

|      |                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------|
| PEO1 | Applying the fundamentals of mathematical, scientific and engineering knowledge and skill for a successful career and/or |
| PEO2 | Pursuing higher education and partaking in research activities and/or                                                    |
| PEO3 | Undertaking entrepreneurship and leadership role to meet the needs of the society.                                       |

#### Program Specific Outcomes (PSO's):

|      |                                                                                                                                                           |
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| PSO1 | Applying knowledge of engineering practices and ethical policies in development and maintenance of software and hardware solutions for real-time problems |
| PSO2 | Ability to pursue higher education and research.                                                                                                          |

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**Program Outcomes (POs): Engineering**  
**Graduates will be able to:**

|    |                                                                                                                                                                |
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| 1  | <b>Engineering knowledge:</b> Apply knowledge of mathematics, science and engineering principles in solving problems related Computer Science and Engineering. |
| 2  | <b>Problem analysis:</b> Investigate, analyze and conduct experiments to establish cause and effect relationships.                                             |
| 3  | <b>Design/development of solutions:</b> Demonstrate the abilities to design and develop algorithms and implement them to optimize the solution.                |
| 4  | <b>Conduct investigations of complex problems:</b> Address the challenges of complex and computation-based problems to create innovative computing methods.    |
| 5  | <b>Modern tool usage:</b> Adopt modern engineering tools or software's for analyzing and solving various computer science engineering problems.                |
| 6  | <b>The engineer and society:</b> Understand the impact of social, cultural, ethical and global aspects in their professional practice.                         |
| 7  | <b>Environment and sustainability:</b> Understand the impact of professional engineering solutions for environmental sustainability.                           |
| 8  | <b>Ethics:</b> Exercise professional and ethical discretion.                                                                                                   |
| 9  | <b>Individual and team work:</b> Visualize and work independently and in teams.                                                                                |
| 10 | <b>Communication:</b> Communicate effectively.                                                                                                                 |
| 11 | <b>Project management and finance:</b> Employ knowledge of contemporary issues to various software engineering approaches for project management.              |
| 12 | <b>Life-long learning:</b> Engage in lifelong learning                                                                                                         |

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**Course outcomes (Cos) of all courses of Computer Science & Engineering**

**Program offered by the institution**

| <b>Course Outcomes for First Year First Semester</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <b>Course Code: 19199101</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: MATHEMATICS-1</b>                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | Transform the knowledge of solving system of linear equations using matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>CO-2</b>                                                 | Apply mean value Rolls, Lag ranges and Cauchy mean value theorem in engineering applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>CO-3</b>                                                 | Acquire the knowledge maxima and minima of function of several variables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>CO-4</b>                                                 | Evaluate multiple integrals and their applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>CO-5</b>                                                 | Understand Beta and Gamma functions, evaluate improper integrals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Course Code: 19199102</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: COMMUNICATIVE ENGLISH -1</b>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | students will be able to develop effective reading strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>CO-2</b>                                                 | will be able to demonstrate writing skills that are required for professional development and use graphic elements for communication                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>CO-3</b>                                                 | will be able to apply grammatical skills and vocabulary effectively in speech and writing                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Course Code: 19199103</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: APPLIED PHYSICS</b>                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | To impart knowledge of physical optical phenomenon like Interference, Diffraction and polarization involving design of optical instruments with higher resolution                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>CO-2</b>                                                 | To demonstrate the concept on the absorption and spontaneous and stimulated emission in two level system and the conditions for laser amplification and explain the working principle of optical fibers and its classification based on refractive index profile and mode of propagation with their applications. To explain the concept of dielectric constant and polarization in dielectric materials and summarize Gauss's law in the presence of dielectrics. and classify the magnetic materials based on susceptibility and their temperature dependence. |
| <b>CO-3</b>                                                 | To study the Schrödinger equation for standard systems with both analytical and numerical methods, and then interpret the results. And to explain the physical states of elementary particles and atoms in different systems based on quantum mechanics                                                                                                                                                                                                                                                                                                          |
| <b>CO-4</b>                                                 | To classify the energy bands of semiconductors and outline the properties of n-type and p-type semiconductors                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Code: 19199104</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: PROBLEM SOLVING &amp; PROGRAMMING IN C</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | Obtain the knowledge about different languages used in computer programming and basic terminology used in the computer programming.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>CO-2</b>                                                 | Write algorithm, flow chart, and structure of C program and make use of different C tokens inside C program.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>CO-3</b>                                                 | Develop program by using Control structure, different looping and Jump statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>CO-4</b>                                                 | Implement applications of Array, Structure and String inside the program. Also acquire the knowledge of different FILE operations.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>CO-5</b>                                                 | Obtain knowledge about accessing the memory in the program and also to develop the program by using different types of function calls.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Course Code: 19193175</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: ENGINEERING GRAPHICS</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | Sketch engineering objects, lettering and dimensioning by freehand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>CO-2</b>                                                 | Apply orthographic projection method to obtain: Multi view, auxiliary view and section view of an object                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>CO-3</b>                                                 | Create 2-D computer drawing setting up working space (units, grids etc.), creating and editing 2-D geometries                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>CO-4</b>                                                 | Create 3-D computer drawing use industry-standard Computer Aided Design (CAD) software to model solid objects proceeding from basic sketching techniques to the creation of solid features through the use of extrusions, cuts, rotations, patterns and sweeps.                                                                                                                                                                                                                                                                                                  |
| <b>Course Code: 19199196a</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Title: ENVIRONMENTAL STUDIES</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>CO-1</b>                                                 | Gain a higher level of personal involvement and interest in understanding and solving environmental problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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| <b>CO-2</b>                                                               | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities                                                                                                    |
| <b>CO-3</b>                                                               | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century                                                                                                      |
| <b>CO-4</b>                                                               | <b>Recognize the interconnectedness of human dependence on the earth's ecosystems</b>                                                                                                                                                 |
| <b>CO-5</b>                                                               | Influence their society in proper utilization of goods and services.                                                                                                                                                                  |
| <b>Course Code: 19199111</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: COMMUNICATIVE ENGLISH LABORATORY-1</b>                   |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | Learning to communicate in English                                                                                                                                                                                                    |
| <b>CO-2</b>                                                               | Comprehend native speakers accent.                                                                                                                                                                                                    |
| <b>CO-3</b>                                                               | Speak appropriately in real life situations                                                                                                                                                                                           |
| <b>Course Code: 19199112</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: ENGINEERING PHYSICS LABORATORY</b>                       |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | To handle optical instruments like microscope and spectrometer, determine thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colors using diffraction grating |
| <b>CO-2</b>                                                               | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance                       |
| <b>CO-3</b>                                                               | To evaluate the acceptance angle of an optical fiber and numerical aperture and determine the resistivity of the given semiconductor using four probe method                                                                          |
| <b>CO-4</b>                                                               | To identify the type of semiconductor i.e., n-type or p-type using Hall effect<br>and determine the band gap of a given semiconductor                                                                                                 |
| <b>Course Code: 19199113</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: PROBLEM SOLVING &amp; PROGRAMMING LABORATORY USING C</b> |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | Know concepts in problem solving.                                                                                                                                                                                                     |
| <b>CO-2</b>                                                               | Analyze a problem and Implement programs in C language.                                                                                                                                                                               |
| <b>CO-3</b>                                                               | Work with arrays, pointers and structures.                                                                                                                                                                                            |
| <b>CO-4</b>                                                               | Apply functions concepts for problem solving.                                                                                                                                                                                         |
| <b>CO-5</b>                                                               | Implement FILE operations for storage purpose.                                                                                                                                                                                        |
| <b>Course Outcomes for First Year Second Semester</b>                     |                                                                                                                                                                                                                                       |
| <b>Course Code: 19199201b</b>                                             |                                                                                                                                                                                                                                       |
| <b>Course Title: PROBABILITY &amp; STATISTICS</b>                         |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | <b>Apply the knowledge of descriptive statistics and method of data science in practical engineering problems.</b>                                                                                                                    |
| <b>CO-2</b>                                                               | <b>Apply the Knowledge of Probability in practical Engineering problems.</b>                                                                                                                                                          |
| <b>CO-3</b>                                                               | <b>Demonstrate the knowledge of Probability distributions.</b>                                                                                                                                                                        |
| <b>CO-4</b>                                                               | <b>Enhance knowledge in Sampling &amp; Estimation techniques.</b>                                                                                                                                                                     |
| <b>CO-5</b>                                                               | <b>Enhance Knowledge in Design of Experiments.</b>                                                                                                                                                                                    |
| <b>Course Code: 19199202</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: COMMUNICATIVE ENGLISH – II</b>                           |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | Paraphrase short academic texts using suitable strategies and conventions                                                                                                                                                             |
| <b>CO-2</b>                                                               | Make formal structured presentations on academic topics using PPT slides with relevant graphical elements                                                                                                                             |
| <b>CO-3</b>                                                               | Build the ability to convey in different communicative forms.                                                                                                                                                                         |
| <b>Course Code: 19199203</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: APPLIED CHEMISTRY</b>                                    |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | Compare different types of cells                                                                                                                                                                                                      |
| <b>CO-2</b>                                                               | Explain the merits of fuel cells                                                                                                                                                                                                      |
| <b>CO-3</b>                                                               | List various sources of renewable energy                                                                                                                                                                                              |
| <b>CO-4</b>                                                               | Distinguish between polymers and plastics                                                                                                                                                                                             |
| <b>CO-5</b>                                                               | Distinguish between nano clusters & nanowires, polymers                                                                                                                                                                               |
| <b>Course Code: 19199204</b>                                              |                                                                                                                                                                                                                                       |
| <b>Course Title: Basic Electrical &amp; Electronics Engineering</b>       |                                                                                                                                                                                                                                       |
| <b>CO-1</b>                                                               | Analyze the various electrical networks                                                                                                                                                                                               |
| <b>CO-2</b>                                                               | Understand the operation of DC machines, 3-point starter and conduct the Swinburne's Test.                                                                                                                                            |
| <b>CO-3</b>                                                               | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                                                                                                                 |

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| <b>CO-4</b>                                                                    | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                                                                                                            |
| <b>CO-5</b>                                                                    | Explain the single stage CE amplifier and concept of feedback amplifier.                                                                                                                                      |
| <b>Course Code: 19199206</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Python Programming</b>                                        |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Handle different data structures.                                                                                                                                                                             |
| <b>CO-2</b>                                                                    | understand the use of control statements, function overloading, operator overloading in real time application                                                                                                 |
| <b>CO-3</b>                                                                    | Implement files using various file operations.                                                                                                                                                                |
| <b>Course Code: 19199211</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Communicative English Laboratory-II</b>                       |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy                                                                                           |
| <b>CO-2</b>                                                                    | speak grammatically correct sentences employing appropriate vocabulary suitable to different contexts                                                                                                         |
| <b>CO-3</b>                                                                    | read for various scholarly materials for information and comprehension                                                                                                                                        |
| <b>Course Code: 19192212</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Basic Electrical &amp; Electronics Engineering Laboratory</b> |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Analyze the various electrical networks                                                                                                                                                                       |
| <b>CO-2</b>                                                                    | Understand the operation or DC machines, 3-point starter and conduct the Swinburne's Test.                                                                                                                    |
| <b>CO-3</b>                                                                    | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                                                                                         |
| <b>CO-4</b>                                                                    | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                                                                                                            |
| <b>CO-5</b>                                                                    | Explain the single stage CE amplifier and concept of feedback amplifier.                                                                                                                                      |
| <b>Course Code: 19195213</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Python Programming Laboratory</b>                             |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Student should be able to understand the basic concepts scripting and the contributions of scripting language                                                                                                 |
| <b>CO-2</b>                                                                    | Ability to explore python especially the object-oriented concepts, and the built in objects of Python.                                                                                                        |
| <b>CO-3</b>                                                                    | Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations                                                                    |
| <b>Course Code: 19199214</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Engineering Chemistry Laboratory</b>                          |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Explain the functioning of the instruments such as pH, Conductivity and Potentiometric meters                                                                                                                 |
| <b>CO-2</b>                                                                    | Determine the total hardness of water                                                                                                                                                                         |
| <b>CO-3</b>                                                                    | Perform various Redox titrations                                                                                                                                                                              |
| <b>CO-4</b>                                                                    | Preparation of polymers                                                                                                                                                                                       |
| <b>CO-5</b>                                                                    | Compare viscosities of different oils                                                                                                                                                                         |
| <b>Course Outcomes for Second Year Third Semester</b>                          |                                                                                                                                                                                                               |
| <b>Course Code: 19159301</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Discrete Mathematics</b>                                      |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Perform operations on discrete structures such as sets, functions, relations, and sequences.                                                                                                                  |
| <b>CO-2</b>                                                                    | Apply algorithms and use definitions to solve problems to prove statements in elementary Number theory.                                                                                                       |
| <b>CO-3</b>                                                                    | Construct mathematical arguments using logical connectives and quantifiers.                                                                                                                                   |
| <b>CO-4</b>                                                                    | Verify the correctness of an argument using propositional and predicate logic and truth Tables.                                                                                                               |
| <b>CO-5</b>                                                                    | Explain basic definitions and properties associated with simple planar graphs, including Isomorphism, connectivity, and Euler's formula, and describe the difference between Eulerian and Hamiltonian graphs. |
| <b>CO-6</b>                                                                    | Use graphs and trees as tools to visualize and simplify situations.                                                                                                                                           |
| <b>Course Code: 19150302</b>                                                   |                                                                                                                                                                                                               |
| <b>Course Title: Object Oriented Programming Through C++</b>                   |                                                                                                                                                                                                               |
| <b>CO-1</b>                                                                    | Describe the procedural and object-oriented paradigm with concepts of data abstraction, inheritance.                                                                                                          |
| <b>CO-2</b>                                                                    | Understand principles of virtual functions and polymorphism                                                                                                                                                   |
| <b>CO-3</b>                                                                    | Describe the concept of exception handling                                                                                                                                                                    |

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| <b>CO-4</b>                                                             | Use object-oriented programming techniques in a wide range of real time applications.                                                                     |
| <b>Course Code: 19150303</b>                                            |                                                                                                                                                           |
| <b>Course Title: Digital Logic &amp; Computer Organization</b>          |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Minimize a Boolean function using Boolean algebra and K-Maps.                                                                                             |
| <b>CO-2</b>                                                             | Model a system as combinational switching circuit and analyze the applications of decoder, encoder, multiplexer and de-multiplexer.                       |
| <b>CO-3</b>                                                             | Model a sequential circuit and design various binary counters.                                                                                            |
| <b>CO-4</b>                                                             | Describe various addressing modes, instruction formats and program control statements.                                                                    |
| <b>CO-5</b>                                                             | Recall the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components.                          |
| <b>Course Code: 19150304</b>                                            |                                                                                                                                                           |
| <b>Course Title: Data Structures</b>                                    |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Choose appropriate data structure as applied to specified problem definition.                                                                             |
| <b>CO-2</b>                                                             | Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.                                              |
| <b>CO-3</b>                                                             | Apply concepts learned in various domains like DBMS, compiler construction                                                                                |
| <b>CO-4</b>                                                             | Use linear and non-linear data structures like stacks, queues, linked list etc.,                                                                          |
| <b>Course Code: 19150305</b>                                            |                                                                                                                                                           |
| <b>Course Title: Data Base Management Systems</b>                       |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Define a Database Management System                                                                                                                       |
| <b>CO-2</b>                                                             | Give a description of the Database Management structure Understand the applications of Databases                                                          |
| <b>CO-3</b>                                                             | Know the advantages and disadvantages of the different models                                                                                             |
| <b>CO-4</b>                                                             | Compare relational model with the Structured Query Language (SQL)                                                                                         |
| <b>CO-5</b>                                                             | Know the constraints and controversies associated with relational Database model. know the rules guiding transaction ACID                                 |
| <b>CO-6</b>                                                             | Understand the concept of data planning and Database design Identify the various functions of Database Administrator                                      |
| <b>Course Code: 19150306</b>                                            |                                                                                                                                                           |
| <b>Course Title: Design Thinking &amp; Product Innovation</b>           |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Create software designs that are scalable and easily maintainable                                                                                         |
| <b>CO-2</b>                                                             | Use structural design patterns for better class and object composition                                                                                    |
| <b>CO-3</b>                                                             | Ability to understand and apply common design patterns to incremental / iterative development.                                                            |
| <b>CO-4</b>                                                             | Ability to identify appropriate patterns for design of given problem.                                                                                     |
| <b>Course Code: 19153311</b>                                            |                                                                                                                                                           |
| <b>Course Title: Basic Engineering Workshop</b>                         |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Assemble and disassemble components of a PC                                                                                                               |
| <b>CO-2</b>                                                             | Construct a fully functional virtual machine, Summarize various Linux operating system commands,                                                          |
| <b>CO-3</b>                                                             | Recognize characters & extract text from scanned images, Create audio files and podcasts                                                                  |
| <b>CO-4</b>                                                             | Assemble and disassemble components of a PC                                                                                                               |
| <b>Course Code: 19150312</b>                                            |                                                                                                                                                           |
| <b>Course Title: Object Oriented Programming Through C++ Laboratory</b> |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Describe OOPs concepts.                                                                                                                                   |
| <b>CO-2</b>                                                             | Understand and describe and use constructors and destructors                                                                                              |
| <b>CO-3</b>                                                             | Create and analyze algorithms for solving simple problems.                                                                                                |
| <b>Course Code: 19150313</b>                                            |                                                                                                                                                           |
| <b>Course Title: Data Structures Laboratory</b>                         |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Ability to understand a systematic approach to organizing, writing and debugging C programs                                                               |
| <b>CO-2</b>                                                             | Create and analyze algorithms for solving simple problems.                                                                                                |
| <b>CO-3</b>                                                             | Ability to choose appropriate data structures to represent data items in real world.                                                                      |
| <b>Course Code: 19150314</b>                                            |                                                                                                                                                           |
| <b>Course Title: Data Base Management Systems Laboratory</b>            |                                                                                                                                                           |
| <b>CO-1</b>                                                             | Students get practical knowledge on designing and creating relational database systems.                                                                   |
| <b>CO-2</b>                                                             | Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL |
| <b>CO-3</b>                                                             | Apply the normalization techniques for development of application                                                                                         |

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**Course Outcomes for Second Year Fourth Semester**

**Course Code: 19150401**

**Course Title: Java Programming**

- |             |                                                                |
|-------------|----------------------------------------------------------------|
| <b>CO-1</b> | Learn the structure of Java Program and its applications       |
| <b>CO-2</b> | Develop a software/application using Java Programming language |
| <b>CO-3</b> | Synthesize the give problem and implement it in Java           |
| <b>CO-4</b> | Choose an engineering approach to solve problems using Java    |

**Course Code: 19150402**

**Course Title: Operating Systems**

- |             |                                                                               |
|-------------|-------------------------------------------------------------------------------|
| <b>CO-1</b> | Describe the general architecture of computers and types of Operating Systems |
| <b>CO-2</b> | Understand the various concepts of process and File System                    |
| <b>CO-3</b> | Implement concurrency mechanisms and Paging Technique                         |
| <b>CO-4</b> | Implement Bankers Algorithms to handle deadlocks and scheduling               |
| <b>CO-5</b> | Design and analyze mechanisms used in memory management                       |

**Course Code: 19150403**

**Course Title: Formal Languages and Automata Theory**

- |             |                                                                                       |
|-------------|---------------------------------------------------------------------------------------|
| <b>CO-1</b> | Appreciate the role and structure of Language theory.                                 |
| <b>CO-2</b> | Design of regular expressions for language constructs and conversions of NFA and DFA. |
| <b>CO-3</b> | Demonstrate the derivations and properties of various CFG and Regular Grammars.       |
| <b>CO-4</b> | Understand the Minimization of CFG's.                                                 |
| <b>CO-5</b> | Appreciate the role of the Turing machine as computational and universal machine      |

**Course Code: 19150404**

**Course Title: Number Theory & Applications**

- |             |                                                                |
|-------------|----------------------------------------------------------------|
| <b>CO-1</b> | Understand the importance of number theory in computer science |
| <b>CO-2</b> | Apply the congruency modulo relations to the cryptography      |
| <b>CO-3</b> | Solve all arithmetic functions and their applications          |

**Course Code: 19150405**

**Course Title: Design and Analysis of Algorithms**

- |             |                                                         |
|-------------|---------------------------------------------------------|
| <b>CO-1</b> | Analyze best and worst-case running times of algorithms |
| <b>CO-2</b> | Describe various algorithm design situation             |
| <b>CO-3</b> | Design engineering problems                             |

**Course Code: 1915046a**

**Course Title: Open Elective-IV (Financial Management for Engineers)**

- |             |                                                          |
|-------------|----------------------------------------------------------|
| <b>CO-1</b> | Understand the basic concepts of Management.             |
| <b>CO-2</b> | Describe the planning process to make decisions.         |
| <b>CO-3</b> | Distinguish between different organizational structures. |

**Course Code: 1915046a**

**Course Title: Open Elective-IV (Entrepreneurship qualities for Engineers)**

- |             |                                                                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Pick up about Foundation of Entrepreneurship Development and its theories                                                                        |
| <b>CO-2</b> | Demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems. |
| <b>CO-3</b> | Analyze the various aspects, scope and challenges under an entrepreneurial venture.                                                              |

**Course Code: 1915046a**

**Course Title: Open Elective-IV (Managerial Economics & Financial Analysis)**

- |             |                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Estimate the Demand and demand elasticities for a product                                                                                                             |
| <b>CO-2</b> | Understand the Input-Output-Cost relationships and estimation of the least cost combination of inputs.                                                                |
| <b>CO-3</b> | Understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units. |

**Course Code: 1915046a**

**Course Title: Open Elective-IV (Principles of Management)**

- |             |                                                                                             |
|-------------|---------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Understand the concepts related to management and different schools of management thoughts. |
| <b>CO-2</b> | Apply the concepts of planning for effective management.                                    |
| <b>CO-3</b> | Identify common organizational structures and the advantages and disadvantages              |

**Course Code: 1915046a**

**Course Title: Open Elective-IV (Organizational Behavior)**

- |             |                                                 |
|-------------|-------------------------------------------------|
| <b>CO-1</b> | Understand the basic concepts of Management.    |
| <b>CO-2</b> | Describe the planning process to make decisions |

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| <b>CO-3</b>                                                   | Know the group dynamic and different leadership style                                                                                                                                    |
| <b>Course Code: 1915046a</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: Open Elective-IV (Digital Marketing)</b>     |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Gain Knowledge of overall understanding of digital marketing                                                                                                                             |
| <b>CO-2</b>                                                   | Develop insight on current trends – digital and social statistics (Infographics)                                                                                                         |
| <b>CO-3</b>                                                   | Provide an introduction to digital marketing platforms like.. Facebook, Twitter, YouTube, Pinterest, etc.                                                                                |
| <b>Course Code: 1915046a</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: Open Elective-IV (Operations Management)</b> |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Identify the elements of operations management and various transformation processes to enhance productivity and competitiveness.                                                         |
| <b>CO-2</b>                                                   | Analyze and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments. |
| <b>CO-3</b>                                                   | Develop aggregate capacity plans and MPS in operation environment.                                                                                                                       |
| <b>Course Code: 19150411</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: Operating Systems Laboratory</b>             |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Implement various CPU scheduling, page replacement and disk scheduling algorithms.                                                                                                       |
| <b>CO-2</b>                                                   | Implement various system calls.                                                                                                                                                          |
| <b>CO-3</b>                                                   | Implement Bankers algorithm for Dead Lock Avoidance and Prevention                                                                                                                       |
| <b>CO-4</b>                                                   | Implement the file allocation strategies                                                                                                                                                 |
| <b>Course Code: 19150412</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: Java Programming Laboratory</b>              |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Write programs for solving real world problems using java collection frame                                                                                                               |
| <b>CO-2</b>                                                   | Write programs using abstract classes                                                                                                                                                    |
| <b>CO-3</b>                                                   | Write multithreaded programs                                                                                                                                                             |
| <b>CO-4</b>                                                   | Write GUI programs using event handling in Java                                                                                                                                          |
| <b>CO-5</b>                                                   | Write programs using applet.                                                                                                                                                             |
| <b>Course Outcomes for Third Year Fifth Semester</b>          |                                                                                                                                                                                          |
| <b>Course Code: 19150501</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: Compiler Design</b>                          |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Realize basics of compiler design and apply for real time applications                                                                                                                   |
| <b>CO-2</b>                                                   | Explore different translation languages                                                                                                                                                  |
| <b>CO-3</b>                                                   | Know about compiler generation tools and techniques                                                                                                                                      |
| <b>CO-4</b>                                                   | Design a compiler for a simple programming language                                                                                                                                      |
| <b>Course Code: 19150502</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: WEB TECHNOLOGIES</b>                         |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Analyze a web page and identify its elements and attributes.                                                                                                                             |
| <b>CO-2</b>                                                   | Create web pages using XHTML and Cascading Styles sheets.                                                                                                                                |
| <b>CO-3</b>                                                   | Build dynamic web pages                                                                                                                                                                  |
| <b>CO-4</b>                                                   | Build web applications using PHP                                                                                                                                                         |
| <b>CO-5</b>                                                   | Write simple client-side scripts using AJAX Programming through PERL.                                                                                                                    |
| <b>Course Code: 19150503</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: SOFTWARE ENGINEERING</b>                     |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Identify, formulate, and solve complex engineering problems by applying principles of software engineering                                                                               |
| <b>CO-2</b>                                                   | Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare.                                                        |
| <b>CO-3</b>                                                   | Acquire and apply new knowledge as needed, using appropriate learning strategies.                                                                                                        |
| <b>CO-4</b>                                                   | Function effectively on a team whose members together provide leadership, objectives.                                                                                                    |
| <b>Course Code: 19150504</b>                                  |                                                                                                                                                                                          |
| <b>Course Title: COMPUTER NETWORKS</b>                        |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Independently understand basic computer network technology.                                                                                                                              |
| <b>CO-2</b>                                                   | Identify the different types of network topologies and protocols.                                                                                                                        |
| <b>CO-3</b>                                                   | Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.                                                                                                 |
| <b>Course Code: 19150505A</b>                                 |                                                                                                                                                                                          |
| <b>Course Title: Advanced JAVA Programming</b>                |                                                                                                                                                                                          |
| <b>CO-1</b>                                                   | Create a full set of UI widgets and other components, including windows, buttons, checkboxes, text fields, scrollbars and scrolling lists, using AWT and Swing.                          |

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| <b>CO-2</b>                                                             | Learn to access database through Java programs, using Java Data Base Connectivity (JDBC)                                                                                                                   |
| <b>CO-3</b>                                                             | Create dynamic web pages, using Servlets and JSP.                                                                                                                                                          |
| <b>CO-4</b>                                                             | Implement a reusable software component, using Java Bean.                                                                                                                                                  |
| <b>Course Code: 19150505B</b>                                           |                                                                                                                                                                                                            |
| <b>Course Title: Principles of Computer Security</b>                    |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Evaluate vulnerability of an information system and establish a plan for risk management.                                                                                                                  |
| <b>CO-2</b>                                                             | Demonstrate basic principles of Web application security                                                                                                                                                   |
| <b>CO-3</b>                                                             | Evaluate the authentication and encryption needs of an information system.                                                                                                                                 |
| <b>CO-4</b>                                                             | Demonstrate how to secure a network                                                                                                                                                                        |
| <b>CO-5</b>                                                             | Evaluate vulnerability of an information system and establish a plan for risk management.                                                                                                                  |
| <b>Course Code: 19150505C</b>                                           |                                                                                                                                                                                                            |
| <b>Course Title: Principles of Computer Security</b>                    |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Think and develop new mobile application.                                                                                                                                                                  |
| <b>CO-2</b>                                                             | Take any new technical issue related to this new paradigm and come up with a solution(s).                                                                                                                  |
| <b>CO-3</b>                                                             | Develop new ad hoc network applications and/or algorithms/protocols.                                                                                                                                       |
| <b>CO-4</b>                                                             | Understand & develop any existing or new protocol related to mobile environment                                                                                                                            |
| <b>CO-5</b>                                                             | Think and develop new mobile application.                                                                                                                                                                  |
| <b>Course Code: 19150511</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Compiler Design &amp; Computer Networks Laboratory</b> |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Gain knowledge base in compiler design and its applications.                                                                                                                                               |
| <b>CO-2</b>                                                             | Identify the different types of network topologies and protocols.                                                                                                                                          |
| <b>CO-3</b>                                                             | Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer                                                                                                                    |
| <b>Course Code: 19150512</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Web Technologies Laboratory</b>                        |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Analyze a web page and identify its elements and attributes.                                                                                                                                               |
| <b>CO-2</b>                                                             | Create web pages using XHTML and Cascading Style Sheets.                                                                                                                                                   |
| <b>CO-3</b>                                                             | Build dynamic web pages using JavaScript (Client-side programming).                                                                                                                                        |
| <b>CO-4</b>                                                             | Create XML documents and Schemas                                                                                                                                                                           |
| <b>Course Code: 19150581</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Community Service Oriented Project</b>                 |                                                                                                                                                                                                            |
| <b>Course Code: 19150522</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Mini Project-1/ Study Project/ Internship</b>          |                                                                                                                                                                                                            |
| <b>Course Outcomes for Third Year Sixth Semester</b>                    |                                                                                                                                                                                                            |
| <b>Course Code: 19150601</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: DATA MINING</b>                                        |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Understand the need of data mining and the way it is different from traditional statistical techniques.                                                                                                    |
| <b>CO-2</b>                                                             | Understand the need and importance of pre-processing techniques                                                                                                                                            |
| <b>CO-3</b>                                                             | Understand and implement classical algorithms in data mining; students will be able to assess the strengths and weaknesses of the algorithms, identify the application area of algorithms, and apply them. |
| <b>CO-4</b>                                                             | Analyze and evaluate performance of algorithms for Association Rules.                                                                                                                                      |
| <b>CO-5</b>                                                             | Analyze Classification and Clustering algorithms                                                                                                                                                           |
| <b>Course Code: 19150602</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Artificial Intelligence</b>                            |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Build intelligent agents for search and games                                                                                                                                                              |
| <b>CO-2</b>                                                             | Solve AI problems through programming with Python                                                                                                                                                          |
| <b>CO-3</b>                                                             | Learning optimization and inference algorithms for model learning                                                                                                                                          |
| <b>CO-4</b>                                                             | Design and develop programs for an agent to learn and act in a structured environment.                                                                                                                     |
| <b>Course Code: 19150603</b>                                            |                                                                                                                                                                                                            |
| <b>Course Title: Unified Modeling Language</b>                          |                                                                                                                                                                                                            |
| <b>CO-1</b>                                                             | Identify the purpose and methods of use of common object-oriented design patterns                                                                                                                          |
| <b>CO-2</b>                                                             | Select and apply these patterns in their own designs for simple programs                                                                                                                                   |
| <b>CO-3</b>                                                             | Represent the data dependencies of a simple program using UML.                                                                                                                                             |

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**Course Code: 19150664A**

**Course Title: PROFESSIONAL ELECTIVE-II (Software Architecture, Frameworks and Patterns)**

|             |                                                                                                                        |
|-------------|------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Understand the Patterns, Design Patterns, Frameworks, Software and To Application Architecture, Types of Architecture. |
| <b>CO-2</b> | Monolithic, Need of Micro services Architecture, MS implementation, MS tools and technologies.                         |
| <b>CO-3</b> | Understand the Core Java Design patterns, GOF, JEE Blue Print patterns and principles.                                 |
| <b>CO-4</b> | Understand what is an API, APIs classification and types, Technology specific APIs, API Tools.                         |
| <b>CO-5</b> | Understand the Patterns, Design Patterns, Frameworks, Software and To Application Architecture, Types of Architecture. |

**Course Code: 19150664B**

**Course Title: PROFESSIONAL ELECTIVE-II (Virtual Reality)**

|             |                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Understanding of techniques, processes, technologies and equipment used in immersive virtual reality     |
| <b>CO-2</b> | Identify critical awareness of historical and theoretical contexts relevant to immersive virtual reality |
| <b>CO-3</b> | Identify and Analyze visualization of image having big data.                                             |

**Course Code: 19150664C**

**Course Title: PROFESSIONAL ELECTIVE-II (Distributed Systems)**

|             |                                                 |
|-------------|-------------------------------------------------|
| <b>CO-1</b> | Discuss trends in Distributed Systems.          |
| <b>CO-2</b> | Apply network virtualization.                   |
| <b>CO-3</b> | Apply remote method invocation and objects.     |
| <b>CO-4</b> | Design process and resource management systems. |
| <b>CO-5</b> | Discuss trends in Distributed Systems.          |

**Course Code: 19150665a**

**Course Title: OPEN ELECTIVE-II (Solid Waste Management)**

|             |                                                               |
|-------------|---------------------------------------------------------------|
| <b>CO-1</b> | Understand the Objects of Solid waste management              |
| <b>CO-2</b> | Understand the elements of Solid waste management             |
| <b>CO-3</b> | Design the Transportation facility in Solid waste management  |
| <b>CO-4</b> | Characterize the solid waste and design a composting facility |
| <b>CO-5</b> | Know the criteria for selection of landfill                   |

**Course Code: 19150665a**

**Course Title: OPEN ELECTIVE-II (Energy Management)**

|             |                                                                                                                                                           |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | To acquire knowledge on Basic functional elements of instrumentation                                                                                      |
| <b>CO-2</b> | Ability to compare between various measurement techniques                                                                                                 |
| <b>CO-3</b> | To acquire knowledge on Various storage and display devices                                                                                               |
| <b>CO-4</b> | To understand the concepts Various transducers and the data acquisition systems                                                                           |
| <b>CO-5</b> | Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System |

**Course Code: 19150665a**

**Course Title: OPEN ELECTIVE-II (MEMS)**

|             |                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Discuss the principles and various steps of different micro machining and fabrication techniques.                |
| <b>CO-2</b> | Explain the working principle and fabrication methods of Micro mechanical sensors and actuators.                 |
| <b>CO-3</b> | Describe the working principles and construction of various thermal sensor and actuators.                        |
| <b>CO-4</b> | Discuss the working principles and fabrication techniques of Magnetic sensors and actuators, and MOEMS devices.  |
| <b>CO-5</b> | Identify different micro fluid actuation techniques and explain the working and construction of BioMEMS devices. |

**Course Code: 19150665a**

**Course Title: OPEN ELECTIVE-II (Digital Image Processing)**

|             |                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Acquire knowledge in the digital image processing for image enhancement as well as restoration of noisy images |
| <b>CO-2</b> | Understand the methods like Image restoration, morphing, segmentation and compression.                         |
| <b>CO-3</b> | Understand and apply various techniques to handle the image data in any field.                                 |

**Course Code: 19150665a**

**Course Title: OPEN ELECTIVE-II (Information Security)**

|             |                                                            |
|-------------|------------------------------------------------------------|
| <b>CO-1</b> | Analyze the security principles and corresponding attacks. |
|-------------|------------------------------------------------------------|

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|                                                                       |                                                                                                                                                                                                        |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-2</b>                                                           | Apply different encryption algorithms to message security                                                                                                                                              |
| <b>CO-3</b>                                                           | Evaluate and Analyze Hashing Algorithms                                                                                                                                                                |
| <b>CO-4</b>                                                           | Study the IP and Transport layer security.                                                                                                                                                             |
| <b>CO-5</b>                                                           | Analyze the security principles and corresponding attacks.                                                                                                                                             |
| <b>Course Code: 19150665a</b>                                         |                                                                                                                                                                                                        |
| <b>Course Title: OPEN ELECTIVE-II (Disaster Management in Mining)</b> |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | To outline the different safety concepts and Job Safety analysis.                                                                                                                                      |
| <b>CO-2</b>                                                           | To outline and explain the Human and vehicle characteristics and protective devices.                                                                                                                   |
| <b>CO-3</b>                                                           | To identify and suggest suitable mitigation measures in construction industry.                                                                                                                         |
| <b>CO-4</b>                                                           | Investigate the Railway risk and safety operations                                                                                                                                                     |
| <b>CO-5</b>                                                           | To explain the operation of various types of Irrigation System Accidents                                                                                                                               |
| <b>Course Code: 19150665a</b>                                         |                                                                                                                                                                                                        |
| <b>Course Title: OPEN ELECTIVE-II (Hybrid and Electric Vehicles)</b>  |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | Understand the architecture and vehicle dynamics of electric and hybrid vehicles                                                                                                                       |
| <b>CO-2</b>                                                           | Analyze and model the power management systems for electric and hybrid vehicles                                                                                                                        |
| <b>CO-3</b>                                                           | Devise power electronics-based control strategies for electric and hybrid vehicles                                                                                                                     |
| <b>CO-4</b>                                                           | Analyze and design various components of electric and hybrid vehicles with environment concern.                                                                                                        |
| <b>CO-5</b>                                                           | Investigate and model the issues in mathematical domain related to grid interconnections of electric and hybrid vehicle.                                                                               |
| <b>Course Code: 19150606</b>                                          |                                                                                                                                                                                                        |
| <b>Course Title: CONSTITUTION OF INDIA</b>                            |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | Understand historical background of the constitution making and its importance for building a democratic India.                                                                                        |
| <b>CO-2</b>                                                           | Understand the functioning of three wings of the government ie., executive, legislative and judiciary.                                                                                                 |
| <b>CO-3</b>                                                           | Understand the value of the fundamental rights and duties for becoming good citizen of India.                                                                                                          |
| <b>CO-4</b>                                                           | Analyze the decentralization of power between central, state and local self-government.                                                                                                                |
| <b>CO-5</b>                                                           | Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.                                                               |
| <b>Course Code: 19150612</b>                                          |                                                                                                                                                                                                        |
| <b>Course Title: AI TOOLS &amp; TECHNIQUES LABORATORY</b>             |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | Build intelligent agents for search and games                                                                                                                                                          |
| <b>CO-2</b>                                                           | Solve AI problems through programming with Python                                                                                                                                                      |
| <b>CO-3</b>                                                           | Learning optimization and inference algorithms for model learning                                                                                                                                      |
| <b>CO-4</b>                                                           | Design and develop programs for an agent to learn and act in a structured environment.                                                                                                                 |
| <b>Course Code: 19150613</b>                                          |                                                                                                                                                                                                        |
| <b>Course Title: UNIFIED MODELING LANGUAGE LABORATORY</b>             |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | Show the importance of systems analysis and design in solving complex problems                                                                                                                         |
| <b>CO-2</b>                                                           | Show how the object-oriented approach differs from the traditional approach to systems analysis and design                                                                                             |
| <b>CO-3</b>                                                           | Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation. |
| <b>CO-4</b>                                                           | Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships                                                                      |
| <b>Course Code: 19150611</b>                                          |                                                                                                                                                                                                        |
| <b>Course Title: Soft Skills</b>                                      |                                                                                                                                                                                                        |
| <b>CO-1</b>                                                           | Be effective communicators and participate in group discussions with confidence. Also be able to make presentations in a professional context.                                                         |
| <b>CO-2</b>                                                           | Write resumes, prepare and face interviews confidently.                                                                                                                                                |
| <b>CO-3</b>                                                           | Be assertive and set short term and long-term goals. Also learn to manage time effectively and deal with stress.                                                                                       |

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|                                                           |                                                                                                                                                                              |
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| <b>CO-4</b>                                               | Make the transition smoothly from campus to corporate.                                                                                                                       |
| <b>CO-5</b>                                               | Be effective communicators and participate in group discussions with confidence. Also be able to make presentations in a professional context.                               |
| <b>Course Outcomes for Fourth Year Seventh Semester</b>   |                                                                                                                                                                              |
| <b>Course Code: 19150701</b>                              |                                                                                                                                                                              |
| <b>Course Title: Cryptography and Network Security</b>    |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Analyze the security principles and corresponding attacks.                                                                                                                   |
| <b>CO-2</b>                                               | Apply different encryption algorithms to message security                                                                                                                    |
| <b>CO-3</b>                                               | Evaluate and Analyze Hashing Algorithms                                                                                                                                      |
| <b>CO-4</b>                                               | Study the IP and Transport layer security.                                                                                                                                   |
| <b>CO-5</b>                                               | Analyze the security principles and corresponding attacks.                                                                                                                   |
| <b>Course Code: 19150702</b>                              |                                                                                                                                                                              |
| <b>Course Title: Machine Learning</b>                     |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Gain knowledge about basic concepts of Machine Learning                                                                                                                      |
| <b>CO-2</b>                                               | Identify machine learning techniques suitable for a given problem                                                                                                            |
| <b>CO-3</b>                                               | Solve the problems using various machine learning techniques                                                                                                                 |
| <b>CO-4</b>                                               | Apply Artificial Neural Networks and Dimensionality reduction techniques.                                                                                                    |
| <b>CO-5</b>                                               | Design application using machine learning techniques.                                                                                                                        |
| <b>Course Code: 19150763A (Professional Elective-III)</b> |                                                                                                                                                                              |
| <b>Course Title: NoSQL Databases</b>                      |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Design and effectively put MongoDB in use for application that demands large volume of data set.                                                                             |
| <b>CO-2</b>                                               | Able to write complex map-reduce functions to aggregate data from multiple notes and derive meaning details out of it.                                                       |
| <b>CO-3</b>                                               | Able to visualize the deployment model, associated security, application architecture.                                                                                       |
| <b>Course Code: 19150763B (Professional Elective-III)</b> |                                                                                                                                                                              |
| <b>Course Title: Digital Image Processing</b>             |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Acquire knowledge in the digital image processing for image enhancement as well as restoration of noisy images                                                               |
| <b>CO-2</b>                                               | Understand the methods like Image restoration, morphing, segmentation and compression.                                                                                       |
| <b>CO-3</b>                                               | Understand and apply various techniques to handle the image data in any field.                                                                                               |
| <b>Course Code: 19150763C (Professional Elective-III)</b> |                                                                                                                                                                              |
| <b>Course Title: Cloud Computing</b>                      |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Understanding the key dimensions of the challenge of Cloud Computing                                                                                                         |
| <b>CO-2</b>                                               | Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization                                                    |
| <b>CO-3</b>                                               | Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.                           |
| <b>CO-4</b>                                               | Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas                                                                |
| <b>CO-5</b>                                               | Understanding the key dimensions of the challenge of Cloud Computing                                                                                                         |
| <b>Course Code: 19150764A (Professional Elective-IV)</b>  |                                                                                                                                                                              |
| <b>Course Title: Big Data Analytics</b>                   |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.                                           |
| <b>CO-2</b>                                               | Acquire fundamental enabling techniques and scalable algorithms like Hadoop in Bigdata Analytics.                                                                            |
| <b>CO-3</b>                                               | Understand the need and application of Map Reduce                                                                                                                            |
| <b>CO-4</b>                                               | Understand Hive to explore and analyze huge datasets.                                                                                                                        |
| <b>CO-5</b>                                               | Understand Spark Framework and execution Model.                                                                                                                              |
| <b>Course Code: 19150764B (Professional Elective-IV)</b>  |                                                                                                                                                                              |
| <b>Course Title: Deep Learning</b>                        |                                                                                                                                                                              |
| <b>CO-1</b>                                               | Understand the concepts of Tensor Flow, its main functions, operations and the execution pipeline                                                                            |
| <b>CO-2</b>                                               | Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely. |
| <b>CO-3</b>                                               | Learn topics such as convolution neural networks, recurrent neural networks, training deep networks and high-level interfaces                                                |
| <b>CO-4</b>                                               | Build deep learning models in Tensor Flow and interpret the results.                                                                                                         |

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| <b>CO-5</b>                                                     | Understand the language and fundamental concepts of artificial neural networks.                                                                                                       |
| <b>Course Code: 19150764C (Professional Elective-IV)</b>        |                                                                                                                                                                                       |
| <b>Course Title: Parallel Computing</b>                         |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | Understand different parallel architectures and models of computation.                                                                                                                |
| <b>CO-2</b>                                                     | Learn parallel algorithms development techniques for shared memory and message passing models.                                                                                        |
| <b>CO-3</b>                                                     | To introduce the various classes of parallel algorithms.                                                                                                                              |
| <b>CO-4</b>                                                     | Study parallel algorithms for basic problems.                                                                                                                                         |
| <b>CO-5</b>                                                     | Study the complexity and correctness models for parallel algorithms.                                                                                                                  |
| <b>Course Code: 19119765a (Open Elective-IV)</b>                |                                                                                                                                                                                       |
| <b>Course Title: Global Environment Problems &amp; Policies</b> |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | To Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.                                                 |
| <b>CO-2</b>                                                     | To Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.                                            |
| <b>CO-3</b>                                                     | To Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.                                            |
| <b>CO-4</b>                                                     | To know environmental laws and grasp the concept of environmental legislation and its application in international environmental agreement.                                           |
| <b>CO-5</b>                                                     | To appreciate the concern of environmental agreement.                                                                                                                                 |
| <b>Course Code: 19129765a (Open Elective-IV)</b>                |                                                                                                                                                                                       |
| <b>Course Title: Renewable Energy Resources</b>                 |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | Analyze solar radiation data, extraterrestrial radiation, radiation on earth's surface.                                                                                               |
| <b>CO-2</b>                                                     | Design solar thermal collections.                                                                                                                                                     |
| <b>CO-3</b>                                                     | Develop maximum power point techniques in solar PV and wind                                                                                                                           |
| <b>CO-4</b>                                                     | Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations                                                                                               |
| <b>Course Code: 19139765a (Open Elective-IV)</b>                |                                                                                                                                                                                       |
| <b>Course Title: Nano Technology</b>                            |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | Describe the classification and applications of nano materials in engineering and other fields.                                                                                       |
| <b>CO-2</b>                                                     | Discuss the mechanical, electrical, thermal and physical properties of nano materials.                                                                                                |
| <b>CO-3</b>                                                     | Explain the synthesis, fabrication and requirements of nano particles.                                                                                                                |
| <b>CO-4</b>                                                     | Describe the uses of characterization techniques such as spectroscopy, SEM, TEM and XRD.                                                                                              |
| <b>CO-5</b>                                                     | Discuss the application of carbon nano technology.                                                                                                                                    |
| <b>Course Code: 19149765a (Open Elective-IV)</b>                |                                                                                                                                                                                       |
| <b>Course Title: Data Communication</b>                         |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | Understand the importance of data communication, the Layered architecture of Open System Interconnection (OSI) and Transmission Control Protocol / Internet Protocol (TCP/IP) models. |
| <b>CO-2</b>                                                     | Understand conversion of signals from Digital to Digital, Analog to Digital & Digital to Analog conversion, bandwidth utilization techniques                                          |
| <b>CO-3</b>                                                     | Understand Error detection and correction techniques, Flow control & error control and DLC services.                                                                                  |
| <b>CO-4</b>                                                     | Understand operations of Channelization protocols, Random Access protocols and Wired & Wireless LAN.                                                                                  |
| <b>CO-5</b>                                                     | Understand the working of 802.11, Cellular Telephony, Bluetooth, IPv4 and IPv6 Addresses.                                                                                             |
| <b>Course Code: 19159765a (Open Elective-IV)</b>                |                                                                                                                                                                                       |
| <b>Course Title: Human Computer Interaction</b>                 |                                                                                                                                                                                       |
| <b>CO-1</b>                                                     | Explain the capabilities of both humans and computers from the viewpoint of human information processing.                                                                             |
| <b>CO-2</b>                                                     | Describe typical human-computer interaction (HCI) models, styles, and various historic HCI paradigms.                                                                                 |
| <b>CO-3</b>                                                     | Apply an interactive design process and universal design principles to designing of systems                                                                                           |

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**Course Code: 19169765a (Open Elective-IV)**

**Course Title: Remote Sensing & GIS in Mining**

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|-------------|-------------------------------------------------------------|
| <b>CO-1</b> | Outline the basic principles of Remote Sensing.             |
| <b>CO-2</b> | Develop the concepts of visual and digital image analysis.  |
| <b>CO-3</b> | Summarize the basic concepts of GIS.                        |
| <b>CO-4</b> | Perform spatial analysis.                                   |
| <b>CO-5</b> | Apply knowledge of remote sensing and GIS in various fields |

**Course Code: 19179765a (Open Elective-IV)**

**Course Title: Modern Vehicle Technology**

- |             |                                                                                          |
|-------------|------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Design and develop modern vehicles                                                       |
| <b>CO-2</b> | Analyze and control the exhaust emissions and noise                                      |
| <b>CO-3</b> | Analyze the vehicle operation and incorporate and develop the electronic control systems |
| <b>CO-4</b> | Distinguish and choose the fuel injection system                                         |
| <b>CO-5</b> | Classify the design analysis of injection systems                                        |

**Course Code: 19199781**

**Course Title: Intellectual Property Rights and Patents**

- |             |                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents           |
| <b>CO-2</b> | Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements |
| <b>CO-3</b> | Enhance technical skills to get patents and understand copyright laws.                                             |
| <b>CO-4</b> | Analyze the Laws relating to the Trade Marks.                                                                      |
| <b>CO-5</b> | Explore the Trade Secrets & Cyber Law and Cyber Crime.                                                             |

**Course Code: 19150711**

**Course Title: Cryptography and Network Security Laboratory**

- |             |                                                            |
|-------------|------------------------------------------------------------|
| <b>CO-1</b> | Analyze the security principles and corresponding attacks. |
| <b>CO-2</b> | Apply different encryption algorithms to message security  |
| <b>CO-3</b> | Evaluate and Analyze Hashing Algorithms                    |
| <b>CO-4</b> | Study the IP and Transport layer security                  |

**Course Code: 19150712**

**Course Title: Machine Learning Laboratory**

- |             |                                                                                                               |
|-------------|---------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | understand complexity of Machine Learning algorithms and their limitations;                                   |
| <b>CO-2</b> | understand modern notions in data analysis-oriented computing;                                                |
| <b>CO-3</b> | be capable of confidently applying common Machine Learning algorithms in practice and implementing their own; |
| <b>CO-4</b> | Be capable of performing experiments in Machine Learning using real-world data                                |

**Course Code: 19150731**

**Course Title: Mini Project-2/ Internship**

- |             |                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | To create an Industrial environment and culture within the institution.                                           |
| <b>CO-2</b> | To standardize laboratories to industrial standard, thereby giving exposure to industrial housekeeping standards. |
| <b>CO-3</b> | To set up production lab utilizing the infrastructure of the institution.                                         |
| <b>CO-4</b> | To give oral presentation related to the work completed                                                           |
| <b>CO-5</b> | To promote the concept of entrepreneurship.                                                                       |

**Course Outcomes for Fourth Year Eighth Semester**

**Course Code: 19150801**

**Course Title: Software Testing Methodologies**

- |             |                                                                                                                                                                         |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Apply software testing knowledge and engineering methods.                                                                                                               |
| <b>CO-2</b> | Design and conduct a software test process for a software testing project.                                                                                              |
| <b>CO-3</b> | Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods. |
| <b>CO-4</b> | Identify the needs of software test automation, and define and develop a test tool to support test automation.                                                          |
| <b>CO-5</b> | Apply software testing knowledge and engineering methods.                                                                                                               |

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|                                                         |                                                                                                                                                                                                              |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Code: 19150862A (Professional Elective-V)</b> |                                                                                                                                                                                                              |
| <b>Course Title: Distributed Databases</b>              |                                                                                                                                                                                                              |
| <b>CO-1</b>                                             | Advanced concepts of Database SQL, PLSQL                                                                                                                                                                     |
| <b>CO-2</b>                                             | Distributed Database and Types.                                                                                                                                                                              |
| <b>CO-3</b>                                             | Database Security                                                                                                                                                                                            |
| <b>CO-4</b>                                             | Database Warehouse and ETL                                                                                                                                                                                   |
| <b>CO-5</b>                                             | Advanced concepts of Database SQL, PLSQL                                                                                                                                                                     |
| <b>Course Code: 19150862B (Professional Elective-V)</b> |                                                                                                                                                                                                              |
| <b>Course Title: Cyber Security</b>                     |                                                                                                                                                                                                              |
| <b>CO-1</b>                                             | Analyze threats and risks within context of the cyber security architecture                                                                                                                                  |
| <b>CO-2</b>                                             | Appraise cyber security incidents to apply appropriate response                                                                                                                                              |
| <b>CO-3</b>                                             | Evaluate decision making outcomes of cyber security scenarios                                                                                                                                                |
| <b>Course Code: 19150862C (Professional Elective-V)</b> |                                                                                                                                                                                                              |
| <b>Course Title: Soft Computing</b>                     |                                                                                                                                                                                                              |
| <b>CO-1</b>                                             | Describe human intelligence of soft computing and explain how intelligent system works                                                                                                                       |
| <b>CO-2</b>                                             | Apply basics of Fuzzy logic and neural networks.                                                                                                                                                             |
| <b>CO-3</b>                                             | Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience                                                                                                                 |
| <b>CO-4</b>                                             | Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems                                                                            |
| <b>CO-5</b>                                             |                                                                                                                                                                                                              |
| <b>Course Code: 19150841</b>                            |                                                                                                                                                                                                              |
| <b>Course Title: Project</b>                            |                                                                                                                                                                                                              |
| <b>CO-1</b>                                             | Understanding how to work in actual industry environment                                                                                                                                                     |
| <b>CO-2</b>                                             | Utilize the technical resources                                                                                                                                                                              |
| <b>CO-3</b>                                             | Write technical/training reports                                                                                                                                                                             |
| <b>CO-4</b>                                             | To give oral presentation related to the work completed                                                                                                                                                      |
| <b>CO-5</b>                                             | To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc. thereby enhancing the skill and competency part of technical education |

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## **GR-19 B.Tech Automobile Engineering**

### **VISION of Automobile Engineering**

To make a preferred destination to the students to become competent automobile engineer to meet the global demands with moral & ethical values and entrepreneurial skills, making the campus vibrant to derive utmost pleasure to both the staff & students, and to be recognised as a pioneer research centre to serve the society through application of scientific and engineering methods, innovative ideas, and discoveries.

### **MISSION of Automobile Engineering**

The department is committed to impart best knowledge through

- teaching regular practices and updating new technologies through utilization of software tools, sophisticated teaching aids
- guest lectures, workshops, seminars and conferences
- bridging the gap between industry and college through frequent industrial visits
- carrying out world class research projects
- inculcating moral & ethical values and encouraging the student towards social work
- developing entrepreneurial skills

### **PROGRAMME EDUCATIONAL OBJECTIVES of Automobile Engineering**

Within a few years after completion of the program the graduate will be;

PEO1: Sound knowledge in mathematical, scientific and engineering fundamentals to meet the professional demands of the automobile industries in India and around the world

PEO2: Synthesize the data, technical concepts and software tools, for application to automotive design and investigation.

PEO3: Design, plan and execute entrepreneurial projects related to automobile industries in orderly manner and can meet financial constraints.

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### PROGRAMME OUTCOMES of Automobile Engineering

At the end of the program the student is able to;

1. Apply the knowledge in mathematics, science and engineering for practical problems with ease.
2. Design and conduct experiments, interpret data, analyze it and report results.
3. Design an Automobile or relevant system that meets the comfort and safety of the user or worker with global standards.
4. Investigate and unearth the causes of failure of automobile components, industrial accidents, road mishaps or crimes.
5. Familiar with modern engineering tools, equipment and software tools to analyze the problems.
6. Confident to apply engineering solutions in global and societal context.
7. Find the causes of environment pollution and solutions for sustainability.
8. Understand the professional and ethical values and act accordingly.
9. Transform the innovative ideas individually as well as with engineering & science laboratory teams and multidisciplinary teams.
10. Communicate effectively in verbally, graphically and written forms to increase coordination and cooperation in the team.
11. Design, plan and execute projects in orderly manner and meet the financial and other constraints.
12. Understand the impact of modern technology on society by the awareness of the contemporary issues and act appropriately throughout life.

### PROGRAMME SPECIFIC OUTCOMES of Automobile Engineering

**PSO 1:** Ability to apply various engineering principles and CAD/CAM software to design, manufacture and analyze automobile systems, subsystems and components.

**PSO 2:** Ability to establish startups in automobile field to manufacture subsystems or vehicle maintenance.

**PSO 3:** Ability to operate, maintain, trouble shoot and rectify various types of automobiles.

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**Course Outcomes of All Semester Courses**

**Course Code: 19198101**

**Course Title: MATHEMATICS-I**

|            |                                                                                                                                                 |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Develop the use of matrix algebra techniques that is needed by engineers for practical applications.                                            |
| <b>CO2</b> | Utilize mean value theorems to real life problems                                                                                               |
| <b>CO3</b> | Familiarize with functions of several variables which is useful in optimization                                                                 |
| <b>CO4</b> | Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional coordinate systems. |
| <b>CO5</b> | Students will become familiar with 3-dimensional coordinate systems and also learn the utilizations of special functions.                       |

**Course Code: 19198102**

**Course Title: COMMUNICATIVE ENGLISH-I**

|             |                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | To apply their learning in different fields and can serve the society accordingly                |
| <b>CO-2</b> | Identify safety measures against different kinds of accidents at home and also in the workplace. |
| <b>CO-3</b> | Experiment the usefulness of animals for the human society                                       |
| <b>CO-4</b> | Appraise writing skills that is required for professional development                            |

**Course Code:**

**Course Title: Engineering Graphics**

|             |                                                                  |
|-------------|------------------------------------------------------------------|
| <b>CO-1</b> | Apply principles of drawing to represent dimensions of an object |
| <b>CO-2</b> | Outline the polygons and engineering curves.                     |
| <b>CO-3</b> | Illustrate projections of points, lines, planes and solids.      |
| <b>CO-4</b> | Illustrate the 3D views through isometric views.                 |
| <b>CO-5</b> | Create the isometric views and orthographic views                |

**Course Code: 19198103**

**Course Title: Engineering Chemistry**

|             |                                                               |
|-------------|---------------------------------------------------------------|
| <b>CO-1</b> | Distinguish between temporary and permanent hardness of water |
|-------------|---------------------------------------------------------------|

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|                                                                 |                                                                                                                                                             |
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| <b>CO-2</b>                                                     | Illustrate the principles and applications of solar                                                                                                         |
| <b>CO-3</b>                                                     | Identify different organic coatings                                                                                                                         |
| <b>CO-4</b>                                                     | Analyse the importance of nano and smart materials.                                                                                                         |
| <b>CO-5</b>                                                     | Distinguish the principles of BET and TEM.                                                                                                                  |
| <b>Course Code: 19192105</b>                                    |                                                                                                                                                             |
| <b>Course Title: Basic electric and electronics engineering</b> |                                                                                                                                                             |
| <b>CO-1</b>                                                     | Analyse the various electrical networks                                                                                                                     |
| <b>CO-2</b>                                                     | Understand the operation of DC machines, 3-point starter and conduct the                                                                                    |
| <b>CO-3</b>                                                     | Analyse the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                                       |
| <b>CO-4</b>                                                     | Analyse the operation of half Wave, full wave rectifiers, op-amps.                                                                                          |
| <b>CO-5</b>                                                     | Explain the single stage CE amplifier and concept of feedback amplifier                                                                                     |
| <b>Course Code: 19198194</b>                                    |                                                                                                                                                             |
| <b>Course Title: Professional ethics &amp; human values</b>     |                                                                                                                                                             |
| <b>CO-1</b>                                                     | Create awareness on professional ethics and Human values.                                                                                                   |
| <b>CO-2</b>                                                     | Create awareness on engineering ethics providing basic knowledge about engineering ethics, Variety of moral dilemmas Professional ideas and virtues         |
| <b>CO-3</b>                                                     | Provide basic familiarity about engineers as responsible experimenters, Research                                                                            |
| <b>CO-4</b>                                                     | Inculcate knowledge and exposure on safety and risk benefit analysis and have an idea about collective bargaining, confidentiality, professional, employee, |
| <b>CO-5</b>                                                     | Have an adequate knowledge about MNC's Business environment, computer ethics                                                                                |
| <b>Course Code: 19198112</b>                                    |                                                                                                                                                             |
| <b>Course Title: Engineering Chemistry Laboratory</b>           |                                                                                                                                                             |
| <b>CO-1</b>                                                     | Estimate the metal content in different ores (Fe, Cr & Cu). (L-3)                                                                                           |
| <b>CO-2</b>                                                     | Compare viscosities of different oils. (1-2)                                                                                                                |
| <b>CO-3</b>                                                     | Analyse the quality of ground water sample. (L-4)                                                                                                           |
| <b>Course Code: 19198111</b>                                    |                                                                                                                                                             |
| <b>Course Title: Communicative English Laboratory</b>           |                                                                                                                                                             |
| <b>CO-1</b>                                                     | Appraise the importance of functional English                                                                                                               |

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| <b>CO-2</b>                                                             | Relate the knowledge to the competitive world.                                                                                                                                   |
| <b>CO-3</b>                                                             | Identify the necessity to follow native speakers' accent                                                                                                                         |
| <b>CO-4</b>                                                             | Experiment how the communicative items in the laboratory will help the students to be effective communicators                                                                    |
| <b>Course Code: 19198113</b>                                            |                                                                                                                                                                                  |
| <b>Course Title: Basic Electrical &amp; Electronics Engineering Lab</b> |                                                                                                                                                                                  |
| <b>CO-1</b>                                                             | Determine performance of electrical machines                                                                                                                                     |
| <b>CO-2</b>                                                             | Determine characteristics of electronic devices                                                                                                                                  |
| <b>CO-3</b>                                                             | Control speed of DC motor                                                                                                                                                        |
| <b>CO-4</b>                                                             | Measure current, voltage and power in a circuit.                                                                                                                                 |
| <b>CO-5</b>                                                             | Determine current and voltage using Kirchhoff's laws.                                                                                                                            |
| <b>Course Code: 19198201</b>                                            |                                                                                                                                                                                  |
| <b>Course Title: MATHEMATICS–II</b>                                     |                                                                                                                                                                                  |
| <b>CO-1</b>                                                             | Solve first order differential equations related to various engineering fields                                                                                                   |
| <b>CO-2</b>                                                             | Identify solution methods for partial differential equations that model                                                                                                          |
| <b>CO-3</b>                                                             | Interpret the physical meaning of different operators such as gradient, curl and divergence                                                                                      |
| <b>CO-4</b>                                                             | Estimate the work done against a field, circulation and flux using vector calculus.                                                                                              |
| <b>Course Code: 1918205</b>                                             |                                                                                                                                                                                  |
| <b>Course Title: Engineering Physics &amp; its applications</b>         |                                                                                                                                                                                  |
| <b>CO-1</b>                                                             | To introduce basic concepts of Mechanics and apply for solving advanced engineering problems related to Earth's rotation in designing and launching missiles.                    |
| <b>CO-2</b>                                                             | To introduce basic and advanced concepts of acoustics and ultrasonics and apply the principles of acoustics for noise cancellation and for medical applications                  |
| <b>CO-3</b>                                                             | To analyse the elastic behaviour of different materials and to identify the fracture/ yielding of materials along with the relationship between elastic constants loads          |
| <b>CO-4</b>                                                             | To introduce basic concepts of heat transfer and thermodynamics and to classify the different modes of transfer of heat energy to evaluate the thermal conductivity of different |
| <b>CO-5</b>                                                             | To introduce basic concepts and working of different sensors and to identify the sensors for various engineering applications.                                                   |
| <b>Course Code: 19195206</b>                                            |                                                                                                                                                                                  |
| <b>Course Title: Problem Solving &amp; Programming in C</b>             |                                                                                                                                                                                  |
| <b>CO-1</b>                                                             | Obtain knowledge about different languages used in computer programming and basic terminology used in computer programming.                                                      |

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|             |                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-2</b> | Write algorithm, flow chart, and structure of C program and make use of different C tokens                                             |
| <b>CO-3</b> | Develop program by using Control structure, different looping and Jump statement.                                                      |
| <b>CO-4</b> | Implement applications of Array, Structure and String inside the program. Also acquire the knowledge of different FILE operations.     |
| <b>CO-5</b> | Obtain knowledge about accessing the memory in the program and also to develop the program by using different types of function calls. |

**Course Code: 19198202**

**Course Title: Communicative English-II**

|             |                                                                                                           |
|-------------|-----------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | At the end of the course, the learners will be able to                                                    |
| <b>CO-2</b> | Prioritize information from reading texts after selecting relevant and useful points                      |
| <b>CO-3</b> | Paraphrase short academic texts using suitable strategies and conventions                                 |
| <b>CO-4</b> | Make formal structured presentations on academic topics using PPT slides with relevant Graphical elements |

**Course Code: 19198293**

**Course Title: Environmental Studies**

|             |                                                                                                                                                                                |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-1</b> | Gain a higher level of personal involvement and interest in understanding and solving environmental problems.                                                                  |
| <b>CO-2</b> | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities                                             |
| <b>CO-3</b> | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century                                               |
| <b>CO-4</b> | Recognize the interconnectedness of human dependence on the earth's ecosystems                                                                                                 |
| <b>CO-5</b> | Influence their society in proper utilization of goods and services.                                                                                                           |
| <b>CO-6</b> | Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices. |

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**Course Title: Engineering Mechanics**

|      |                                                                                                                                                                                                                                |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body. Describe the concept of friction and analyse the equilibrium of rigid bodies subjected to force. |
| CO-2 | Analyse planar and spatial systems to determine the forces in members, to understand the concepts of Equilibrium of Systems of Forces, law of Triangle of forces and converse of the law of polygon of forces                  |
| CO-3 | Discuss the concepts of "centre of gravity" and "centroids" and compute their location for bodies of arbitrary shape, to understand the concepts of Area moments of Inertia, Mass Moment of Inertia.                           |
| CO-4 | Illustrate the laws of motion, kinematics of motion and their inter relationship.                                                                                                                                              |
| CO-5 | Able to determine basic dynamics concepts - the Work-Energy principle, Impulse- Momentum principle and to understand the concepts of Equations for Translation, D'Alembert's principle in rotation.                            |

**Course Code: 19198205**

**Course Title: ENGINEERING PHYSICS LABORATORY**

|      |                                                                                                                                                                                                                                        |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | To handle optical instruments like microscope and spectrometer, determine thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colours using diffraction grating |
| CO-2 | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance                        |
| CO-3 | To evaluate the acceleration due to gravity using compound pendulum                                                                                                                                                                    |
| CO-4 | To determine the moment of inertia using Fly wheel                                                                                                                                                                                     |

**Course Code: 19198211**

**Course Title: COMMUNICATIVE ENGLISH LABORATORY II**

|      |                                                                                        |
|------|----------------------------------------------------------------------------------------|
| CO-1 | Paraphrase short academic texts using suitable strategies and conventions.             |
| CO-2 | Make formal structured presentations on academic topics using PPT slides with relevant |
| CO-3 | Graphical elements                                                                     |

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|      |                                                                                        |
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| CO-4 | Participate in group discussions using appropriate conventions and language strategies |
| CO-5 | Prepare a CV with a cover letter to seek internship/job                                |
| CO-6 | Collaborate with a partner to make presentations and Project Reports                   |

|                                                       |                                                                                                                                 |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>COURSE CODE: 19179301</b>                          |                                                                                                                                 |
| <b>COURSE TITLE: MATHEMATICS-III</b>                  |                                                                                                                                 |
| CO-1                                                  | Differentiation and Integration of Complex Functions used in engineering problems                                               |
| CO-2                                                  | Apply the Laplace transform for solving differential equations (continuous systems)                                             |
| CO-3                                                  | Find the Fourier series of periodic signals                                                                                     |
| CO-4                                                  | Know and be able apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms |
| CO-5                                                  | Find the general solutions of the PDEs bearing applications                                                                     |
| <b>COURSE CODE: 19170302</b>                          |                                                                                                                                 |
| <b>COURSE TITLE: Basic Automobile Engineering</b>     |                                                                                                                                 |
| CO-1                                                  | Compare different types of automobiles and their components                                                                     |
| CO-2                                                  | Differentiate working principles of different types of automobile engines                                                       |
| CO-3                                                  | Illustrate working of different transmission elements and control systems                                                       |
| CO-4                                                  | Implement different types of safety systems.                                                                                    |
| CO-5                                                  | Implement effective pollution reduction methods                                                                                 |
| <b>COURSE CODE: 19170303</b>                          |                                                                                                                                 |
| <b>COURSE TITLE: Metallurgy and Materials Science</b> |                                                                                                                                 |
| CO-1                                                  | Demonstrate the knowledge of science and fundamentals of materials                                                              |
| CO-2                                                  | Describe the regions of stability of phases that occur in the alloy systems.                                                    |

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| <b>CO-3</b>                                                   | Able to classify steels and cast Irons with applications.                                                                              |
| <b>CO-4</b>                                                   | Able to select heat treatment methods and non-ferrous materials                                                                        |
| <b>CO-5</b>                                                   | Explain the concept of ceramics and composites                                                                                         |
| <b>COURSE CODE: 19170304</b>                                  |                                                                                                                                        |
| <b>COURSE TITLE: Mechanics of Solids</b>                      |                                                                                                                                        |
| <b>CO-1</b>                                                   | Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials |
| <b>CO-2</b>                                                   | Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings       |
| <b>CO-3</b>                                                   | Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural.              |
| <b>CO-4</b>                                                   | Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels                                |
| <b>CO-5</b>                                                   | Able to calculate the failure load of column and struts with different type of end condition.                                          |
| <b>COURSE CODE: 19170305</b>                                  |                                                                                                                                        |
| <b>COURSE TITLE: Fluid Mechanics and Hydraulic Machinery</b>  |                                                                                                                                        |
| <b>CO-1</b>                                                   | Describe the properties of fluids and explain the mechanics of fluids at rest and in motion by observing the fluid phenomena           |
| <b>CO-2</b>                                                   | Distinguish the types of flows and continuity equation                                                                                 |
| <b>CO-3</b>                                                   | Derive Euler's Equations of motion and Deduce Bernoulli's equation                                                                     |
| <b>CO-4</b>                                                   | Examine energy losses in pipe transitions and sketch energy gradient lines.                                                            |
| <b>CO-5</b>                                                   | Describe Basic working of hydraulic turbines and hydraulic pumps.                                                                      |
| <b>COURSE CODE: 19170386</b>                                  |                                                                                                                                        |
| <b>COURSE TITLE: Design Thinking &amp; Product Innovation</b> |                                                                                                                                        |
| <b>CO-1</b>                                                   | Immerse into the world of innovation.                                                                                                  |
| <b>CO-2</b>                                                   | Provide a thinking space for new alternatives products.                                                                                |

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| <b>CO-3</b>                                                        | Generate low risk ideas                                       |
| <b>CO-4</b>                                                        | Negotiate with organisation                                   |
| <b>CO-5</b>                                                        | Deliver more valued and successful solutions                  |
| <b>COURSE CODE: 19170377</b>                                       |                                                               |
| <b>COURSE TITLE: Computer Aided Engineering Drawing Practice</b>   |                                                               |
| <b>CO-1</b>                                                        | Construct the diagrams in engineering                         |
| <b>CO-2</b>                                                        | Modify the drawing using modern engineering software tools    |
| <b>CO-3</b>                                                        | Produce the drawing based on ISO and BIS Standards            |
| <b>CO-4</b>                                                        | Design various components of an automobile                    |
| <b>CO-5</b>                                                        | Reconstruct the drawings and invent new designs of components |
| <b>COURSE CODE: 19170311</b>                                       |                                                               |
| <b>COURSE TITLE: Automobile Chassis Components Lab</b>             |                                                               |
| <b>CO-1</b>                                                        | Differentiate and contrast different types of automobiles     |
| <b>CO-2</b>                                                        | Demonstrate different types of engines                        |
| <b>CO-3</b>                                                        | Demonstrate different components of automobile                |
| <b>CO-4</b>                                                        | Analyze different power transmission elements                 |
| <b>CO-5</b>                                                        | Organize different vehicle control systems.                   |
| <b>COURSE CODE: 19170312</b>                                       |                                                               |
| <b>COURSE TITLE: Mechanics of Solids &amp; Fluid Mechanics Lab</b> |                                                               |
| <b>CO-1</b>                                                        | Distinguish properties of different types of materials        |
| <b>CO-2</b>                                                        | Investigate different failures of machine components          |
| <b>CO-3</b>                                                        | Apply different materials for different applications          |
| <b>CO-4</b>                                                        | Illustrate different property measuring machines              |

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| <b>CO-5</b>                                                           | Apply hydraulic principles to various systems of automobiles such as fuel, Lubricant, cooling and aerodynamic                                                        |
| <b>Course Code: 19179401</b>                                          |                                                                                                                                                                      |
| <b>Course Title: Numerical Methods and Probability and Statistics</b> |                                                                                                                                                                      |
| <b>CO-1</b>                                                           | Apply the knowledge of descriptive statistics and method of data science in practical engineering problems                                                           |
| <b>CO-2</b>                                                           | Apply the knowledge of Probability in Practical Engineering problems                                                                                                 |
| <b>CO-3</b>                                                           | Demonstrate the knowledge of Probability distributions                                                                                                               |
| <b>CO-4</b>                                                           | Enhance the knowledge of a classical hypothesis techniques                                                                                                           |
| <b>CO-5</b>                                                           | Enhance the knowledge in inferential methods based on small and large sampling tests                                                                                 |
| <b>Course Code: 19170402</b>                                          |                                                                                                                                                                      |
| <b>Course Title: Kinematics of Machinery</b>                          |                                                                                                                                                                      |
| <b>CO-1</b>                                                           | To know about the degrees of freedom for a particular combination of linkages                                                                                        |
| <b>CO-2</b>                                                           | Understand the working of different mechanisms                                                                                                                       |
| <b>CO-3</b>                                                           | The kinematics of machines deals with the motion of members of the mechanisms which includes the determination of velocities and acceleration of the machine members |
| <b>CO-4</b>                                                           | Analyse the motion of the cams and followers                                                                                                                         |
| <b>CO-5</b>                                                           | Understand the motion of the component of the mechanism's automobile and gear trains                                                                                 |
| <b>Course Code: Automotive Engines</b>                                |                                                                                                                                                                      |
| <b>Course Title: 19170403</b>                                         |                                                                                                                                                                      |
| <b>CO-1</b>                                                           | Analyse and conduct the experiments of the automotive SI and CI engines                                                                                              |
| <b>CO-2</b>                                                           | Investigate the thermochemistry of air-fuel mixtures                                                                                                                 |
| <b>CO-3</b>                                                           | Compare the properties and combustion of gasoline, diesel fuel processes                                                                                             |
| <b>CO-4</b>                                                           | Design and solve the problems of various operating parameters of the engine                                                                                          |
| <b>CO-5</b>                                                           | Analyse and plot the performance and pollution characteristics of IC engines                                                                                         |

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| <b>Course Code: 19170404</b>                                   |                                                                                                                                  |
| <b>Course Title: Thermodynamics</b>                            |                                                                                                                                  |
| <b>CO-1</b>                                                    | Explain the importance of thermodynamic properties related to conversion of heat energy into work                                |
| <b>CO-2</b>                                                    | Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles                    |
| <b>CO-3</b>                                                    | Utilize steam properties to design steam-based components                                                                        |
| <b>CO-4</b>                                                    | Compare thermodynamic relations and air standard cycles                                                                          |
| <b>CO-5</b>                                                    | Applications of the thermodynamics in Engineering                                                                                |
| <b>Course Code: 19170475</b>                                   |                                                                                                                                  |
| <b>Course Title: Machine Drawing</b>                           |                                                                                                                                  |
| <b>CO-1</b>                                                    | Memorize the International standards                                                                                             |
| <b>CO-2</b>                                                    | Construct the part drawing of mechanical components                                                                              |
| <b>CO-3</b>                                                    | Produce the drawings based on ISO and BIS standards                                                                              |
| <b>CO-4</b>                                                    | Design and assemble various components of an automobile                                                                          |
| <b>CO-5</b>                                                    | Reconstruct the drawings and invent new designs of components                                                                    |
| <b>Course Code: 19170701</b>                                   |                                                                                                                                  |
| <b>Course Title: VEHICLE DYNAMICS</b>                          |                                                                                                                                  |
| <b>CO-1</b>                                                    | To make the student to analyze various kinds of vibrations                                                                       |
| <b>CO-2</b>                                                    | To make the student to distinguish various kinds of vibrations caused due to different aspects like uneven road engine unbalance |
| <b>CO-3</b>                                                    | To make the student to measure the intensity of vibration                                                                        |
| <b>CO-4</b>                                                    | To make the student to reduce the vibration effect on the vehicle                                                                |
| <b>Course Code: 19170702</b>                                   |                                                                                                                                  |
| <b>Course Title: HYBRID, ELECTRIC &amp; FUEL CELL VEHICLES</b> |                                                                                                                                  |
| <b>CO-1</b>                                                    | Operation of fuel cell technology                                                                                                |
| <b>CO-2</b>                                                    | Identification of fuel-based vehicles                                                                                            |

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|                                             |                                                                                              |
|---------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>CO-3</b>                                 | Determination of hybrid electric technology and electronic drive trains                      |
| <b>CO-4</b>                                 | Construction of hybrid electric vehicles                                                     |
| <b>CO-5</b>                                 | Construction of hybrid electric technology                                                   |
| <b>Course Code: 19170703</b>                |                                                                                              |
| <b>Course Title: FINITE ELEMENT METHODS</b> |                                                                                              |
| <b>CO-1</b>                                 | Illustrate the concepts behind variational and weighted residual methods in FEM              |
| <b>CO-2</b>                                 | Analyze the applications and characteristics of finite element modelling                     |
| <b>CO-3</b>                                 | Investigate element characteristic equation and generate global stiffness matrix             |
| <b>CO-4</b>                                 | Apply suitable boundary conditions to a global structural matrix equation and reduce it.     |
| <b>CO-5</b>                                 | Identify an appropriate FEM approach to solve problems involving dynamics and heat transfer  |
| <b>Course Code: 19170704</b>                |                                                                                              |
| <b>Course Title: CAD/CAM</b>                |                                                                                              |
| <b>CO-1</b>                                 | Explain the basic concepts of CAD and computer graphics                                      |
| <b>CO-2</b>                                 | Solve the mathematical models to represent various geometries                                |
| <b>CO-3</b>                                 | Compose the part programs of engineering components                                          |
| <b>CO-4</b>                                 | Explain the concepts of group technology and computer aided quality control                  |
| <b>CO-5</b>                                 | Discuss the elements of Flexible Manufacturing systems and computer integrated Manufacturing |
| <b>Course Code: 19170765B</b>               |                                                                                              |
| <b>Course Title: VEHICLE MAINTENANCE</b>    |                                                                                              |
| <b>CO-1</b>                                 | Importance of Vehicle Maintenance                                                            |
| <b>CO-2</b>                                 | Service Procedure of engine and subsystems                                                   |
| <b>CO-3</b>                                 | Service procedure of drive line                                                              |
| <b>CO-4</b>                                 | Service Procedure of Chassis components                                                      |

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|                                                                               |                                                                                                                                    |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO-5</b>                                                                   | Maintenance of electrical and air conditioning System                                                                              |
| <b>Course Code:1919766a</b>                                                   |                                                                                                                                    |
| <b>Course Title: Managerial Economics and Financial Analysis</b>              |                                                                                                                                    |
| <b>CO-1</b>                                                                   | Analyze the scope of Managerial Economics                                                                                          |
| <b>CO-2</b>                                                                   | Analyze various aspects of Managerial Economics, Production cost, analysis markets & pricing strategies                            |
| <b>CO-3</b>                                                                   | Develop an ability to identify, formulate and solve engineering problems by applying the subject knowledge of managerial economics |
| <b>CO-4</b>                                                                   | Apply capital budgeting, financial analysis techniques in evaluating in various investment opportunities                           |
| <b>CO-5</b>                                                                   | Enhance their capabilities in the interpretation of balance sheets are followed in industries, organizations                       |
| <b>Course Code:19170787</b>                                                   |                                                                                                                                    |
| <b>Course Title: INTELLECTUAL PROPERTY RIGHTS AND PATENTS</b>                 |                                                                                                                                    |
| <b>CO-1</b>                                                                   | To understand the concepts of Intellectual property rights                                                                         |
| <b>CO-2</b>                                                                   | Develops procedural knowledge to legal system and solving the problem relating to Intellectual property rights                     |
| <b>CO-3</b>                                                                   | Skill to pursue the professional programs in company, laws, Business, International Affairs and other fields                       |
| <b>CO-4</b>                                                                   | Employability as the Compliance officer and Liaison officer                                                                        |
| <b>CO-5</b>                                                                   | Establishment of Legal Consultancy and service provider cyber crime                                                                |
| <b>Course Code:19170711</b>                                                   |                                                                                                                                    |
| <b>Course Title: SERVICING, MAINTENANCE &amp; SCANNING OF AUTOMOBILES LAB</b> |                                                                                                                                    |
| <b>CO-1</b>                                                                   | Assemble and dis-assemble the various components of an automobile                                                                  |
| <b>CO-2</b>                                                                   | Troubleshoot the vehicle to identify the problem location                                                                          |
| <b>CO-3</b>                                                                   | Test and overhaul the components of a vehicle                                                                                      |
| <b>CO-4</b>                                                                   | Calibrate measuring instruments                                                                                                    |
| <b>Course Code:19170712</b>                                                   |                                                                                                                                    |

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**Course Title: CAD/CAM Lab**

|             |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| <b>CO-1</b> | Analyze various types of 2D and 3D trusses by static and dynamic analysis using ANSYS. |
| <b>CO-2</b> | Solve the static problems involving corner bracket and cylinder components.            |
| <b>CO-3</b> | Examine the beams with various and conditions subjected to static load.                |
| <b>CO-4</b> | Analyze various thermal properties of bodies with different geometries.                |
| <b>CO-5</b> | Compose NC code for turning and pocket milling operations.                             |

**Course Code:19170861a**

**Course Title: RAPID PROTOTYPING**

|             |                                                                                         |
|-------------|-----------------------------------------------------------------------------------------|
| <b>CO-1</b> | Describe rapid prototyping and tooling systems.                                         |
| <b>CO-2</b> | Recommend the part orientation and slicing methods for rapid prototyping of given part. |
| <b>CO-3</b> | Identify process parameters of liquid based rapid prototyping to improve the quality.   |
| <b>CO-4</b> | Illustrate powder and solid based rapid prototyping processes.                          |
| <b>CO-5</b> | Identify process parameters for powder and solid based rapid prototyping.               |

**Course Code:19170861b**

**Course Title: VEHICLE PERFORMANCE & TESTING**

|             |                                                      |
|-------------|------------------------------------------------------|
| <b>CO-1</b> | Investigate the vehicle performance                  |
| <b>CO-2</b> | Determine the vehicle testing                        |
| <b>CO-3</b> | Detect the transmission performance                  |
| <b>CO-4</b> | Operate the control systems                          |
| <b>CO-5</b> | Determine the testing of vehicles on road and truck. |

**Course Code:19170861d**

**Course Title: PRINCIPLES OF ENTREPRENEURSHIP**

|             |                                                       |
|-------------|-------------------------------------------------------|
| <b>CO-1</b> | Demonstrate entrepreneurship                          |
| <b>CO-2</b> | Classify the product planning and development process |
| <b>CO-3</b> | Identify the public issues and bonus issues           |

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|                                                                 |                                                                     |
|-----------------------------------------------------------------|---------------------------------------------------------------------|
| CO-4                                                            | Discover about production and marketing management methods          |
| CO-5                                                            | Distinguish about motivation and leading teams                      |
| <b>Course Code:19170861e</b>                                    |                                                                     |
| <b>Course Title: ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES</b> |                                                                     |
| CO-1                                                            | Classify the types of alternate fuels                               |
| CO-2                                                            | Determine the performance of vegetable oils in IC Engines           |
| CO-3                                                            | Operate hydrogen in IC Engines                                      |
| CO-4                                                            | Differentiate about Biogas, Natural gas and LPG                     |
| CO-5                                                            | Construct about different types of electric vehicles                |
| <b>Course Code:19170862e</b>                                    |                                                                     |
| <b>Course Title: MODERN VEHICLE TECHNOLOGY</b>                  |                                                                     |
| CO-1                                                            | Design and develop modern vehicles                                  |
| CO-2                                                            | Identify the suspension systems in automobile vehicles              |
| CO-3                                                            | Analyze braking operation in automobile vehicle                     |
| CO-4                                                            | Analyze and control the exhaust emissions and noise                 |
| CO-5                                                            | Distinguish and choose the fuel injection system                    |
| <b>Course Code:19170841</b>                                     |                                                                     |
| <b>Course Title: PROJECT WORK</b>                               |                                                                     |
| CO-1                                                            | Analyze the technical procedure of planning                         |
| CO-2                                                            | Analyze the technical procedure scheduling                          |
| CO-3                                                            | Realizing an engineering product                                    |
| CO-4                                                            | Acquire the skills of technical report writing and data collection. |
| CO-5                                                            | Examine the result analysis.                                        |

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## GR-19 B.Tech Mining Engineering

### B. TECH – MINING ENGINEERING

**Department Vision:** To be recognized as a National Centre of Excellence in Mining Engineering to cope with the challenges of sustainable development in Mining industry.

#### Department Mission:

1. To provide high quality Programmes supported by up-to- date curriculum and practical courses.
2. We prepare students to understand eco-friendly and sustainable development in mining industry.
3. Extensive practical courses to foster learning by observation.
4. Exposing students to various mining projects to reinforce their classroom / laboratory learning.
5. Sensitization towards ethical, social responsibilities, leadership, entrepreneurship, communication skills and lifelong learning.

#### Program Educational Objectives (PEOs):

|             |                                                                                                                             |
|-------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>PEO1</b> | Plan and design mine project operations                                                                                     |
| <b>PEO2</b> | Apply engineering skills/techniques to manage mining operations effectively and able to solve Mining engineering problems.. |
| <b>PEO3</b> | Be able to design/execute all project operations of surface and underground mining projects in an eco-friendly manner. .    |

#### Program Specific Outcomes (PSO's):

|             |                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b> | Ability to pursue higher education and research.                                                                                      |
| <b>PSO2</b> | Develop strong skills in systematic planning, developing, implementing in different domains for betterment of life                    |
| <b>PSO3</b> | Plan and operate mining projects by using various engineering/technological tools to meet the volatile needs of the industry.         |
| <b>PSO4</b> | Advance themselves professionally and personally by accepting professional and social responsibilities and pursuing leadership roles. |

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**Program Outcomes (POs): Engineering**  
**Graduates will be able to:**

|    |                                                                                                                                  |
|----|----------------------------------------------------------------------------------------------------------------------------------|
| 1  | Apply skills/techniques to solve the problems of projects.                                                                       |
| 2  | Critically analyze and interpret the data to solve project problems                                                              |
| 3  | Plan and design the mine layouts to evaluate the project performance and productivity.                                           |
| 4  | Manage & execute the project plans to meet goals of economic, environmental, social, political, ethical, health and safety.      |
| 5  | Apply latest skills/techniques of computer software, modern instrumentation, novel technologies in engineering activities.       |
| 6  | Comprehend the efficiency of mines, allied industries and suggest solutions in improving the economics, safety and optimization. |
| 7  | Comprehend the professional and ethical values.                                                                                  |
| 8  | Comprehend need for higher learning and engage in life-long learning.                                                            |
| 9  | Make effective communication in verbal and written forms with confidence.                                                        |
| 10 | Demonstrate leadership in project planning/ execution to obtain quality and quantity.                                            |
| 11 | Demonstrate teamwork with other teams of inter-disciplinary department                                                           |
| 12 | Excel and improvise their skills under challenging circumstances at their projects.                                              |

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**Course outcomes (Cos) of all courses of all programs offered by the institution**

|                                                                   |                                                                                                                       |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Course outcomes for First Year First Semester Course</b>       |                                                                                                                       |
| <b>Course Code: 19198101</b>                                      |                                                                                                                       |
| <b>Course Title: Mathematics - I</b>                              |                                                                                                                       |
| CO1:                                                              | Transform the knowledge of solving system of linear equations using matrices.                                         |
| CO2:                                                              | Evaluate nature of the Quadratic form.                                                                                |
| CO3:                                                              | Acquire the knowledge maxima and minima of function of several variables.                                             |
| CO4:                                                              | Evaluate multiple integrals and their applications.                                                                   |
| CO5:                                                              | Understand and apply vector derivatives and vector integration theorems.                                              |
| <b>Course Code: 19198102</b>                                      |                                                                                                                       |
| <b>Course Title: Communicative English-I</b>                      |                                                                                                                       |
| CO1:                                                              | Develop effective reading strategies                                                                                  |
| CO2:                                                              | Demonstrate writing skills that are required for professional development and use graphic elements for communication. |
| CO3:                                                              | Apply grammatical skills and vocabulary effectively in speech and writing                                             |
| CO4:                                                              | Display language efficacy in tune with subjective knowledge                                                           |
| CO5:                                                              | Use required language along with contextual vocabulary and grammar structures                                         |
| <b>Course Code: 19198103</b>                                      |                                                                                                                       |
| <b>Course Title: Engineering Chemistry</b>                        |                                                                                                                       |
| CO1:                                                              | Understand the removal techniques of hardness of water                                                                |
| CO2:                                                              | Distinguish the fuel cells and batteries                                                                              |
| CO3:                                                              | Identify different control techniques of corrosion                                                                    |
| CO4:                                                              | Understand the concepts of plastics and rubbers                                                                       |
| CO5:                                                              | Analyse the importance of nanomaterials.                                                                              |
| <b>Course Code : 201EE104</b>                                     |                                                                                                                       |
| <b>Course Title: Professional ethics and human values</b>         |                                                                                                                       |
| CO1:                                                              | Analyze the ethical dilemmas                                                                                          |
| CO2:                                                              | Apply ethical theories                                                                                                |
| CO3:                                                              | Analyze the moral reasoning                                                                                           |
| CO4:                                                              | Analyze the ethical leadership.                                                                                       |
| CO5:                                                              | Reflect on personal values                                                                                            |
| <b>Course Code: 19192105</b>                                      |                                                                                                                       |
| <b>Course Title: Basic Electrical and Electronics Engineering</b> |                                                                                                                       |
| CO1:                                                              | Analyze the various electrical networks                                                                               |
| CO2:                                                              | Understand the operation of DC machines, 3-point starter and conduct the Swinburne's Test.                            |
| CO3:                                                              | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                 |
| CO4:                                                              | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                    |
| CO5:                                                              | Explain the single stage CE amplifier and concept of feedback amplifier.                                              |
| <b>Course Code: 191931</b>                                        |                                                                                                                       |
| <b>Course Title: Engineering Graphics</b>                         |                                                                                                                       |
| CO1:                                                              | Apply principles of drawing to represent dimensions of an object.                                                     |
| CO2:                                                              | Outline the polygons and engineering curves.                                                                          |
| CO3:                                                              | Illustrate projections of points, lines, planes and solids.                                                           |
| CO4:                                                              | Illustrate the 3D views through isometric views.                                                                      |
| CO5:                                                              | Create the isometric views and orthographic views                                                                     |
| <b>Course Code: 19198111</b>                                      |                                                                                                                       |
| <b>Course Title: Communicative English laboratory</b>             |                                                                                                                       |
| CO1:                                                              | Learn to communicate in English                                                                                       |
| CO2:                                                              | Comprehend native speaker's accent                                                                                    |
| CO3:                                                              | Speak appropriately in real life situations                                                                           |
| CO4:                                                              | Display public speaking skills in the required context                                                                |
| CO5:                                                              | Handle different communicative situations                                                                             |
| <b>Course Code: 219198112</b>                                     |                                                                                                                       |
| <b>Course Title: Engineering chemistry laboratory</b>             |                                                                                                                       |
| CO1:                                                              | Explain the functioning of the instruments such as pH, conductivity, and potentiometric meters.                       |
| CO2:                                                              | Determine the total hardness of water                                                                                 |
| CO3:                                                              | Perform various redox titrations.                                                                                     |

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| CO4:                                                                  | Preparation of polymers                                                                                                                           |
| CO5:                                                                  | Compare viscosities of different oils                                                                                                             |
| <b>Course Code: 19198214</b>                                          |                                                                                                                                                   |
| <b>Course Title: Basic electrical and electronics engineering lab</b> |                                                                                                                                                   |
| CO1:                                                                  | Analyze the various electrical networks                                                                                                           |
| CO2:                                                                  | Understand the operation of DC machines, 3-point starter and conduct the Swinburne's Test.                                                        |
| CO3:                                                                  | Analyze the performance of transformer, operation of 3-phase alternator and 3-phase induction motors.                                             |
| CO4:                                                                  | Analyze the operation of half Wave, full wave rectifiers, op-amps.                                                                                |
| CO5:                                                                  | Explain the single stage CE amplifier and concept of feedback amplifier.                                                                          |
| <b>Course outcomes for First Year Second Semester Course</b>          |                                                                                                                                                   |
| <b>Course Code: 19198201</b>                                          |                                                                                                                                                   |
| <b>Course Title: Mathematics – II</b>                                 |                                                                                                                                                   |
| CO1:                                                                  | Solve first order differential equations.                                                                                                         |
| CO2:                                                                  | Solve higher order differential equations with constant coefficients                                                                              |
| CO3:                                                                  | Apply the knowledge of approximating and find the roots of polynomial and transcendental equation in practical engineering problems.              |
| CO4:                                                                  | Understand numerical differentiation and integration.                                                                                             |
| CO5:                                                                  | Apply the knowledge of different algorithms for approximating the solution of ordinary differential equations in practical engineering problems.  |
| <b>Course Code: 19198202</b>                                          |                                                                                                                                                   |
| <b>Course Title: Communicative english - II</b>                       |                                                                                                                                                   |
| CO1:                                                                  | Prioritize information from reading texts after selecting relevant and useful points                                                              |
| CO2:                                                                  | Paraphrase short academic texts using suitable strategies and conventions                                                                         |
| CO3:                                                                  | Make formal structured presentations on academic topics using PPT slides with relevant graphical elements                                         |
| CO4:                                                                  | Decipher the meaning of unfamiliar text and transform into the familiar form                                                                      |
| CO5:                                                                  | Build the ability to convey in different communicative forms.                                                                                     |
| <b>Course Code: 19198293</b>                                          |                                                                                                                                                   |
| <b>Course Title: Environmental studies</b>                            |                                                                                                                                                   |
| CO1:                                                                  | Gain a higher level of personal involvement and interest in understanding and solving environmental problems                                      |
| CO2:                                                                  | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and development activities                  |
| CO3:                                                                  | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21 <sup>st</sup> century      |
| CO4:                                                                  | Recognize the interconnections of human dependence on the earth's ecosystems                                                                      |
| CO5:                                                                  | Influence their society in proper utilization of goods and services                                                                               |
| <b>Course Code: 19193204</b>                                          |                                                                                                                                                   |
| <b>Course Title: Engineering Mechanics</b>                            |                                                                                                                                                   |
| CO1:                                                                  | Carry out composition of system of forces.                                                                                                        |
| CO2:                                                                  | Analyse rigid bodies in static equilibrium condition under system of forces including friction.                                                   |
| CO3:                                                                  | Determine centre of gravity and moment of inertia of simple and composite planar, solid sections.                                                 |
| CO4:                                                                  | Carry out dynamic analysis of rigid bodies under translation, rotation and plane motion.                                                          |
| CO5:                                                                  | Apply work energy and impulse momentum principles to rigid body motion.                                                                           |
| <b>Course Code: 19198205</b>                                          |                                                                                                                                                   |
| <b>Course Title: Engineering Physics and its applications</b>         |                                                                                                                                                   |
| CO1:                                                                  | Fundamental Understanding of Physical Principles                                                                                                  |
| CO2:                                                                  | Students will learn to apply the principles of physics to real-world engineering problems and technologies                                        |
| CO3:                                                                  | Advanced Computational Skills                                                                                                                     |
| CO4:                                                                  | Interdisciplinary Problem-Solving                                                                                                                 |
| CO5:                                                                  | Innovation and Research Capabilities                                                                                                              |
| <b>Course Code: 19195206</b>                                          |                                                                                                                                                   |
| <b>Course Title: problem solving and programming in C</b>             |                                                                                                                                                   |
| CO1:                                                                  | Students will acquire a strong grasp of the C programming language, including its syntax, data types, control structures, functions, and pointers |
| CO2:                                                                  | Algorithmic Thinking and Problem-Solving Skills                                                                                                   |

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| CO3:                                                                 | Debugging and Troubleshooting                                                                                                                                                                                                          |
| CO4:                                                                 | The course will introduce students to fundamental data structures, such as arrays, linked lists, stacks, and queues                                                                                                                    |
| CO5:                                                                 | Application Development: Students will gain practical experience in developing C-based applications                                                                                                                                    |
| <b>Course Code: 19198211</b>                                         |                                                                                                                                                                                                                                        |
| <b>Course Title: Communicative English Laboratory - II</b>           |                                                                                                                                                                                                                                        |
| CO1:                                                                 | Communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy.                                                                                                                   |
| CO2:                                                                 | Write grammatically correct sentences employing appropriate vocabulary suitable to different contexts                                                                                                                                  |
| CO3:                                                                 | Comprehend and analyze different academic texts                                                                                                                                                                                        |
| CO4:                                                                 | Meet communicative needs across the globe                                                                                                                                                                                              |
| CO5:                                                                 | Identify their skills like leadership, teambuilding and managerial skills                                                                                                                                                              |
| <b>Course Code: 19198212</b>                                         |                                                                                                                                                                                                                                        |
| <b>Course Title: Engineering physics laboratory</b>                  |                                                                                                                                                                                                                                        |
| CO1:                                                                 | To handle optical instruments like microscope and spectrometer, determine thickness of a hair/paper with the concept of interference and to estimate the wavelength and resolving power of different colours using diffraction grating |
| CO2:                                                                 | To demonstrate the importance of dielectric material in storage of electric field energy in the capacitors and plot the intensity of the magnetic field of circular coil carrying current with varying distance                        |
| CO3:                                                                 | To evaluate the acceleration due to gravity using compound pendulum                                                                                                                                                                    |
| CO4:                                                                 | To determine the moment of inertia using Fly wheel                                                                                                                                                                                     |
| <b>Course Code: 19198213</b>                                         |                                                                                                                                                                                                                                        |
| <b>Course Title: Basic Engineering workshop</b>                      |                                                                                                                                                                                                                                        |
| CO1:                                                                 | Experiment with various basic house wiring techniques.                                                                                                                                                                                 |
| CO2:                                                                 | Develop basic prototype in the trade of tin smithy such as square tray and open scoop.                                                                                                                                                 |
| CO3:                                                                 | Design v-fitting and square fitting in the trade of fitting                                                                                                                                                                            |
| CO4:                                                                 | Making square rod and L-bend from the round rod in black smithy                                                                                                                                                                        |
| CO5:                                                                 | Build various prototype like T lap joint, dovetail joint, cross lap etc. in the trade of carpentry.                                                                                                                                    |
| <b>Course Code: 19198214</b>                                         |                                                                                                                                                                                                                                        |
| <b>Course Title: problem solving and programming in C laboratory</b> |                                                                                                                                                                                                                                        |
| CO1:                                                                 | Students will acquire a strong grasp of the C programming language, including its syntax, data types, control structures, functions, and pointers                                                                                      |
| CO2:                                                                 | Algorithmic Thinking and Problem-Solving Skills                                                                                                                                                                                        |
| CO3:                                                                 | Debugging and Troubleshooting                                                                                                                                                                                                          |
| CO4:                                                                 | The course will introduce students to fundamental data structures, such as arrays, linked lists, stacks, and queues                                                                                                                    |
| CO5:                                                                 | Application Development: Students will gain practical experience in developing C-based applications                                                                                                                                    |

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**Course Outcomes for Second Year First Semester Course**

**Course Code: 19169301**

**Course Title: Mathematics - III**

- |      |                                                                                                                                 |
|------|---------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Continuity, analytic and C-R equations of complex function, evaluate Taylor and Laurent series and apply Cauchy residue theorem |
| CO-2 | Understand properties of Laplace and inverse Laplace transformations, apply to solve differential equations                     |
| CO-3 | Evaluate Fourier series for different functions                                                                                 |
| CO-4 | Understand properties of Fourier transformation apply for different function                                                    |
| CO-5 | Classify nature of pde's and solve boundary value problems                                                                      |

**Course Code: 19163302**

**Course Title: Fluid Mechanics & Hydraulic Machinery**

- |      |                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the basis fluid properties and fluid flow phenomenon                                        |
| CO-2 | Generate mathematical models of fluid motion including steady, unsteady flow and boundary layer theory |
| CO-3 | State and visualize fluid kinematics.                                                                  |
| CO-4 | Describe basic working of single and multi-stage air compressors                                       |
| CO-5 | Calculate performance and design of pumps                                                              |

**Course Code: 19160303**

**Course Title: Mine Surveying**

- |      |                                                                                       |
|------|---------------------------------------------------------------------------------------|
| CO-1 | Measure relative positions of objects below or above the earth surface .              |
| CO-2 | Identify the parts of surveying instruments and calculate horizontal, vertical angles |
| CO-3 | Evaluate the elevation of field objects and contour intervals                         |
| CO-4 | Perform using plane table surveying                                                   |
| CO-5 | Utilize modern surveying techniques in field                                          |

**Course Code: 19160304**

**Course Title: Introductory Geology**

- |      |                                                                                                       |
|------|-------------------------------------------------------------------------------------------------------|
| CO-1 | Understand the role of geology in the design and construction process of underground openings in rock |
| CO-2 | Be able to use knowledge in identifying the minerals basing on physical properties                    |
| CO-3 | Be able to use knowledge in identifying the minerals basing on optical properties                     |
| CO-4 | Be able to identify and classify rock using basic geologic classification systems                     |

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|                                                               |                                                                                                                                                                                                                                       |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-5                                                          | Be able to apply geologic concepts and approaches on rock engineering projects                                                                                                                                                        |
| <b>Course Code: 19160305</b>                                  |                                                                                                                                                                                                                                       |
| <b>Course Title: Development of Mineral Deposits</b>          |                                                                                                                                                                                                                                       |
| CO-1                                                          | To gain exposure in field of mining activities along with concept relating to history of mining, role of mining in economic development, various mineral exploration techniques, various mining methods and unit operations in mining |
| CO-2                                                          | To gain exposure in various modes of mine access in underground and opencast mining. Basic of bench formation and slope stability                                                                                                     |
| CO-3                                                          | To gain exposure in shaft sinking operation in mining. Various factors affecting shaft sinking, various method of shaft sinking including special methods                                                                             |
| CO-4                                                          | To gain exposure for mining development including incline, raise, winze, crosscut, drift etc, ventilation, transportation and lighting arrangements.                                                                                  |
| CO-5                                                          | To gain exposure in field of mining support system.                                                                                                                                                                                   |
| <b>Course Code: 19160306</b>                                  |                                                                                                                                                                                                                                       |
| <b>Course Title: Drilling &amp; Blasting</b>                  |                                                                                                                                                                                                                                       |
| CO-1                                                          | Learn the various methods of drilling and rock breakage process.                                                                                                                                                                      |
| CO-2                                                          | Select appropriate methods of drilling and rock breakage for given in-situ rock conditions                                                                                                                                            |
| CO-3                                                          | Identify relevant requirements for the security, storage and handling of explosives.                                                                                                                                                  |
| CO-4                                                          | Design blasts to achieve optimum results; manage and control blast damage and environmental impact.;                                                                                                                                  |
| CO-5                                                          | Apply fundamental principles to the design and selection of safe and efficient blasting.                                                                                                                                              |
| <b>Course Code: 19160387</b>                                  |                                                                                                                                                                                                                                       |
| <b>Course Title: Design Thinking &amp; Product Innovation</b> |                                                                                                                                                                                                                                       |
| CO-1                                                          | Proficiency in Programming Basics: Students will gain hands-on experience in implementing fundamental programming concept                                                                                                             |
| CO-2                                                          | Algorithm Design and Implementation: Through practical exercises, students will learn to design algorithms and translate them into working programs                                                                                   |
| CO-3                                                          | Debugging and Error Handling: The course will equip students with essential debugging skills to identify and fix errors in their programs.                                                                                            |
| CO-4                                                          | Data Structure and Algorithm Practice: Students will be exposed to various data structures, such as arrays, linked lists, stacks, and queues                                                                                          |
| CO-5                                                          | Software Development Practices: Students will experience the software development lifecycle by                                                                                                                                        |

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|                                                                           |                                                                                                                                                 |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           | working on coding assignments and projects                                                                                                      |
| <b>Course Code:19163311</b>                                               |                                                                                                                                                 |
| <b>Course Title: Fluid Mechanics &amp; Hydraulic Machinery Laboratory</b> |                                                                                                                                                 |
| CO-1                                                                      | Understand the importance and theory of Fluid mechanics(Level 5)                                                                                |
| CO-2                                                                      | Finding head loss due to friction in pipes by Darcy we is Bach equation (Level 4)                                                               |
| CO-3                                                                      | Calculating performance analysis in turbines and pumps (Level 3)                                                                                |
| CO-4                                                                      | Conduct experiments (in teams)in pipe flows and open-channel flows and interpreting data from model studies to prototype cases(Level 2)         |
| CO-5                                                                      | Given the required flow rate and pressure rise, select the proper pump to optimize the pumping efficiency(Level 1)                              |
| <b>Course Code:19163312</b>                                               |                                                                                                                                                 |
| <b>Course Title: Mine Surveying Laboratory</b>                            |                                                                                                                                                 |
| CO-1                                                                      | Measure relative positions of objects below or above the earth surface                                                                          |
| CO-2                                                                      | Identify the parts of surveying instruments and calculate horizontal, vertical angles.                                                          |
| CO-3                                                                      | Evaluate the elevation of field objects and contour intervals                                                                                   |
| CO-4                                                                      | Perform using plane table surveying                                                                                                             |
| CO-5                                                                      | Utilize modern surveying techniques in field                                                                                                    |
| <b>Course Outcomes for Second Year Second Semester Course</b>             |                                                                                                                                                 |
| <b>Course Code:19169401</b>                                               |                                                                                                                                                 |
| <b>Course Title: Numerical Methods and Probability &amp; Statistics</b>   |                                                                                                                                                 |
| CO-1                                                                      | Apply the knowledge of approximating the roots of polynomial and transcendental equation in practical engineering problems.                     |
| CO-2                                                                      | Apply the Knowledge of different algorithms for approximating the solution of ordinary differential equations in practical Engineering problems |
| CO-3                                                                      | Demonstrate the knowledge of Probability distributions.                                                                                         |
| CO-4                                                                      | Enhances knowledge of a classical hypothesis techniques.                                                                                        |
| CO-5                                                                      | Enhances Knowledge in inferential methods based on small and large sampling tests.                                                              |
| <b>Course Code: 19163466a</b>                                             |                                                                                                                                                 |
| <b>Course Title: Elements of Mining Technology</b>                        |                                                                                                                                                 |
| CO-1                                                                      | Know the various Elements of Mining and stages/phases in Mining                                                                                 |
| CO-2                                                                      | Know the concepts of Mining Methods.                                                                                                            |
| CO-3                                                                      | Know the Drilling methods.                                                                                                                      |

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|                                                         |                                                                                          |
|---------------------------------------------------------|------------------------------------------------------------------------------------------|
| CO-4                                                    | Understand the explosives.                                                               |
| CO-5                                                    | Blasting practice in mines.                                                              |
| <b>Course Code: 19160402</b>                            |                                                                                          |
| <b>Course Title: Advanced Mine Surveying</b>            |                                                                                          |
| CO-1                                                    | Understanding the measurements of distances and angles.                                  |
| CO-2                                                    | Able to setting out various curves                                                       |
| CO-3                                                    | Measuring the areas and volumes by using various methods.                                |
| CO-4                                                    | Understanding the various methods of plotting survey                                     |
| CO-5                                                    | Using the advanced surveying techniques of total station.                                |
| <b>Course Code: 19160403</b>                            |                                                                                          |
| <b>Course Title: Surface Mining</b>                     |                                                                                          |
| CO-1                                                    | Differentiate various systems of surface mining and their applications                   |
| CO-2                                                    | Design the opening up of the deposits and Bench formations.                              |
| CO-3                                                    | Compare various excavating and loading equipment                                         |
| CO-4                                                    | Formulate the production capacities of various HEMM.                                     |
| CO-5                                                    | Apply fundamental principles to the design and selection of safe and efficient blasting. |
| <b>Course Code: 19160404</b>                            |                                                                                          |
| <b>Course Title: Underground Coal Mining</b>            |                                                                                          |
| CO-1                                                    | Infer the factors influencing choice of mining methods and possible entries.             |
| CO-2                                                    | Perform the development and depillaring operations in bord and pillar mining             |
| CO-3                                                    | Summarize the development and extraction using long wall mining method                   |
| CO-4                                                    | valuate different challenges associated with thick seam mining                           |
| CO-5                                                    | Plan the extraction of coal using modern mining methods.                                 |
| <b>Course Code: 19160405</b>                            |                                                                                          |
| <b>Course Title: Mining Geology</b>                     |                                                                                          |
| CO-1                                                    | Outline the engineering concepts of geological and hydrological elements                 |
| CO-2                                                    | Classify processes of ore minerals formations, origin, occurrence and uses               |
| CO-3                                                    | <b>Infer the basic attribute geology</b>                                                 |
| CO-4                                                    | Relate economic viability of mineral                                                     |
| CO-5                                                    | Summarize various prospecting methods for mineral deposit.                               |
| <b>Course Code: 19160411</b>                            |                                                                                          |
| <b>Course Title: Advanced Mine Surveying Laboratory</b> |                                                                                          |
| CO-1                                                    | Understand the basics of Tachometric survey.                                             |

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|      |                                                                    |
|------|--------------------------------------------------------------------|
| CO-2 | Set out curves by using various surveying methods and instruments. |
| CO-3 | Set out curves by using various surveying methods and instruments. |
| CO-4 | Design the mine plans by using various methods.                    |
| CO-5 | Correlate surface, underground survey and stop survey.             |

**Course Code: 19160412**

**Course Title: Mining Geology Laboratory**

|      |                                                                                      |
|------|--------------------------------------------------------------------------------------|
| CO-1 | Observe and analyse the Geo-morphology and geological structure of a particular area |
| CO-2 | Measure attitude of bed using physical properties                                    |
| CO-3 | Examine the mineral physical properties                                              |
| CO-4 | Identify the mega scope properties of rocks                                          |
| CO-5 | Categorize the geological formations                                                 |
| CO-1 | Observe and analyse the Geo-morphology and geological structure of a particular area |

**Course Outcomes for Third Year First Semester Course**

**Course Code: 19160501**

**Course Title: Mining systems engineering**

|      |                                                                                |
|------|--------------------------------------------------------------------------------|
| CO-1 | Solve the real-life problems on Linear programming and allocation              |
| CO-2 | Comprehend the transportation, assignment, sequencing and replacement concepts |
| CO-3 | Comprehend the concept of games, waiting lines.                                |
| CO-4 | Comprehend and analyze inventory and break-even analysis.                      |
| CO-5 | Solve dynamic programming problems and understand the concept of simulation    |

**Course Code: 19160502**

**Course Title: Underground Metal Mining**

|      |                                                                                         |
|------|-----------------------------------------------------------------------------------------|
| CO-1 | Comprehend the terminology used in underground metal mining, their scope and limitation |
| CO-2 | Comprehend the terminology used in underground metal mining, their scope and limitation |
| CO-3 | Summarize the raising methods used in underground metal mining.                         |
| CO-4 | Summarize the raising methods used in underground metal mining.                         |
| CO-5 | Discuss different special stopping methods, their applicability with limitations.       |

**Course Code: 19160503**

**Course Title: Mine Ventilation**

|      |                                                             |
|------|-------------------------------------------------------------|
| CO-1 | Comprehend the mine atmosphere, monitoring, and its control |
|------|-------------------------------------------------------------|

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|                                                                     |                                                                                                 |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| CO-2                                                                | Comprehend the mine atmosphere, monitoring, and its control                                     |
| CO-3                                                                | Comprehend the mine atmosphere, monitoring, and its control                                     |
| CO-4                                                                | Interpret and perform the mine ventilation survey.                                              |
| CO-5                                                                | Comprehend the mine atmosphere, monitoring, and its control                                     |
| <b>Course Code:19160504</b>                                         |                                                                                                 |
| <b>Course Title: Mine Planning &amp; Design</b>                     |                                                                                                 |
| CO-1                                                                | Comprehend and plan different stages in new mines.                                              |
| CO-2                                                                | Analyse and prepare different plan reports.                                                     |
| CO-3                                                                | Interpret the design, planning of ventilation and infrastructure in mines.                      |
| CO-4                                                                | Analyse the concept of open-pit design.                                                         |
| CO-5                                                                | Comprehend the process of mine reclamation, rehabilitation, and corporate social responsibility |
| <b>Course Code:19160565A</b>                                        |                                                                                                 |
| <b>Course Title: Mine Transportation ( Professional Elective-1)</b> |                                                                                                 |
| CO-1                                                                | Assess the principles, operations and application of conveyors..                                |
| CO-2                                                                | Demonstrate different types of rope haulage and its application.                                |
| CO-3                                                                | Identify various locomotive haulage systems                                                     |
| CO-4                                                                | Demonstrate various types of winding systems in mine                                            |
| CO-5                                                                | Comprehend skip and koepe winding in mines.                                                     |
| <b>Course Code: 19160565B</b>                                       |                                                                                                 |
| <b>Course Title: Mine Valuation ( Professional Elective-1)</b>      |                                                                                                 |
| CO-1                                                                | Comprehend and practice mine management aspects.                                                |
| CO-2                                                                | Appraise the importance of personal management and human relations                              |
| CO-3                                                                | Perform work study environment and comprehend operation management                              |
| CO-4                                                                | Outline the concepts of behavioural sciences for management.                                    |
| CO-5                                                                | comprehend the principles of maintenance and marketing management.                              |
| <b>Course Code: 19160565C OKKKK</b>                                 |                                                                                                 |
| <b>Course Title: Rock Excavation( Professional Elective-1)</b>      |                                                                                                 |
| CO-1                                                                | Comprehend the rock breaking theory.                                                            |
| CO-2                                                                | Summarize rock properties related to rock excavation.                                           |
| CO-3                                                                | Appraise the technology used in rock cutting                                                    |
| CO-4                                                                | Classify various rock cutting tools and their applications                                      |
| CO-5                                                                | Compare various rock excavating machines                                                        |

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**Course Code: 19160565D**

**Course Title: Advanced Coal Mining ( Professional Elective-1)**

|      |                                                                   |
|------|-------------------------------------------------------------------|
| CO-1 | Comprehend the coal face mechanization                            |
| CO-2 | Summarize the problems associated with thick seam mining          |
| CO-3 | Appraise the technology used in hydraulic mining.                 |
| CO-4 | Classify various long wall mining methods and their applications. |
| CO-5 | Comprehend underground coal gasification.                         |

**Course Code: 19160565E**

**Course Title: Environmental Pollution & Control in Mines ( Professional Elective-1)**

|      |                                                                                                                                   |
|------|-----------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Assess air pollution in mines.                                                                                                    |
| CO-2 | Comprehend water pollution in mines.                                                                                              |
| CO-3 | Appraise the importance of noise pollution in mines.                                                                              |
| CO-4 | Perform the biological land reclamation                                                                                           |
| CO-5 | Perceive the basic information required for the preparation of environmental impact Assessment and environmental management plan. |

**Course Code: 19160511**

**Course Title: Mine Ventilation Lab**

|      |                                                                        |
|------|------------------------------------------------------------------------|
| CO-1 | Comprehend the mine atmosphere, monitoring and its control.            |
| CO-2 | Evaluate the various mine heat sources and cooling system in mines.    |
| CO-3 | Compare different types of natural and mechanical ventilation systems. |
| CO-4 | Interpret and perform the mine ventilation survey.                     |
| CO-5 | Perform the tests using various flame safety lamps.                    |

**Course Code: 19160512**

**Course Title: Mine Planning and Design Lab**

|      |                                                                            |
|------|----------------------------------------------------------------------------|
| CO-1 | Comprehend and plan different stages in new mines..                        |
| CO-2 | Analyse and prepare different plan reports.                                |
| CO-3 | Interpret the design, planning of ventilation and infrastructure in mines. |
| CO-4 | Analyse the concept of open-pit design.                                    |
| CO-5 | Calculate the production obtained by using various machinery               |

**Course Code: 19160521**

**Course Title: Mini Project-1/Study Project/Internship**

|      |                                                                                                            |
|------|------------------------------------------------------------------------------------------------------------|
| CO-1 | Practical Application of Theoretical Concepts: Students will have the opportunity to apply the theoretical |
|------|------------------------------------------------------------------------------------------------------------|

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|      |                                                                                                                                                                                                                                                                                                                   |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | knowledge gained during their coursework to real-world situations                                                                                                                                                                                                                                                 |
| CO-2 | Problem-Solving and Analytical Skills: Through their mini project, study project, or internship, students will develop problem-solving and analytical skills                                                                                                                                                      |
| CO-3 | Project Management and Time-Management: Engaging in a mini project or internship will expose students to project management principles and time-management techniques                                                                                                                                             |
| CO-4 | Collaboration and Communication: Working on a mini project or internship will foster collaboration and effective communication skills. Students will often collaborate with peers, mentors, or industry professionals, allowing them to practice teamwork and effectively convey their ideas and progress.        |
| CO-5 | Professional Development: The mini project, study project, or internship experience will contribute significantly to students' professional development. It will help them build a portfolio of practical work, enhance their resume, and provide valuable insights into their chosen field of study or industry. |

**Course Outcomes for Third Year Second Semester Course**

**Course Code: 19160601**

**Course Title: Rock Mechanics**

|      |                                                                                   |
|------|-----------------------------------------------------------------------------------|
| CO-1 | Appraise the importance of rock mechanics and physio-MINING properties of rock    |
| CO-2 | Analyse the stress-strain in rocks.                                               |
| CO-3 | Outline inset stress measurement techniques and geophysical investigation methods |
| CO-4 | Differentiate among various rock mass classifications and rock failure criterion. |
| CO-5 | Analyse the various modes of slope failure and its stabilization techniques.      |

**Course Code: 19160602**

**Course Title: Mineral Processing**

|      |                                                                                       |
|------|---------------------------------------------------------------------------------------|
| CO-1 | Classify various sampling methods..                                                   |
| CO-2 | Comprehend and explain the settling of solids.                                        |
| CO-3 | Appraise the beneficiation process and its applications.                              |
| CO-4 | Appraise the beneficiation process and its applications.                              |
| CO-5 | Comprehend and analyze the efficiency of operations in mineral processing industries. |

**Course Code: 19160603**

**Course Title: Mineral Economics**

|      |                                                                          |
|------|--------------------------------------------------------------------------|
| CO-1 | Summarize the various policies, acts and conservation rules on minerals. |
| CO-2 | Analyze the mineral taxation laws and pricing mechanism of minerals.     |
| CO-3 | Interpret various sampling methods.                                      |
| CO-4 | Estimate the reserves using various estimation methods.                  |
| CO-5 | Analyze the mine finance and model optimum size of mine.                 |

**Course Code: 19160664A**

**Course Title: Planning of Surface Mines( Professional Elective-2)**

|      |                                                             |
|------|-------------------------------------------------------------|
| CO-1 | Comprehend the stages of mine planning and planning inputs. |
|------|-------------------------------------------------------------|

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|                                                                                         |                                                                                         |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| CO-2                                                                                    | Estimate ore reserve and stripping ratio.                                               |
| CO-3                                                                                    | Outline the geometrical considerations of bench and pit.                                |
| CO-4                                                                                    | Assess the design parameters of dump slope and determine optimum mine size.             |
| CO-5                                                                                    | Plan and design haul roads in mines.                                                    |
| <b>Course Code: 19160664B</b>                                                           |                                                                                         |
| <b>Course Title: . Enterprise Resource Planning ( Professional Elective-2)</b>          |                                                                                         |
| CO-1                                                                                    | Infer ERP and related technologies with applications                                    |
| CO-2                                                                                    | Explain Product life cycle, ERP implementation, evaluation and selection.               |
| CO-3                                                                                    | Outline different ERP business modules.                                                 |
| CO-4                                                                                    | Explain the ERP post implementation effects in Business environments.                   |
| CO-5                                                                                    | Comprehend the emerging future trends in ERP systems.                                   |
| <b>Course Code: 19160664C</b>                                                           |                                                                                         |
| <b>Course Title: Mine Strata Control ( Professional Elective-2)</b>                     |                                                                                         |
| CO-1                                                                                    | Assess the pre and post mining stresses, strata behaviour in mines.                     |
| CO-2                                                                                    | Classify the various support systems in underground mines.                              |
| CO-3                                                                                    | Distinguish the different methods of stowing in development and depillaring operations. |
| CO-4                                                                                    | A Relate the theories of ground movement.                                               |
| CO-5                                                                                    | Comprehend the mechanism of subsidence and its prevention's                             |
| <b>Course Code: 19160664D</b>                                                           |                                                                                         |
| <b>Course Title: Innovative Mining Systems( Professional Elective-2)</b>                |                                                                                         |
| CO-1                                                                                    | Comprehend and analyze the technological life cycle of mine operations.                 |
| CO-2                                                                                    | Appraise the basics of system dynamics involved in innovative mine systems.             |
| CO-3                                                                                    | Comprehend the new developments in mine operations..                                    |
| CO-4                                                                                    | Apprehend the new frontiers of mining in real world                                     |
| CO-5                                                                                    | Design and introduce automation and robotics in mine operation.                         |
| <b>Course Code: 19160664E</b>                                                           |                                                                                         |
| <b>Course Title: Environmental Impact Assessment in Mines( Professional Elective-2)</b> |                                                                                         |
| CO-1                                                                                    | Comprehend the concept of environmental impact assessment.                              |
| CO-2                                                                                    | Assess the types and limitations of environmental impact assessment..                   |
| CO-3                                                                                    | Identify the components of environmental impact assessment.                             |
| CO-4                                                                                    | Predict the impacts of environmental impact assessment.                                 |
| CO-5                                                                                    | Appraise the statutory requirement for mine environment management.                     |

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**Course Code:19163665a**

**Course Title: Renewable Energy Resources Open Elective – 3**

|      |                                                                                         |
|------|-----------------------------------------------------------------------------------------|
| CO-1 | Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface |
| CO-2 | Design solar thermal collections.                                                       |
| CO-3 | Develop maximum power point techniques in solar PV and wind                             |
| CO-4 | Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitation  |

**Course Code:19160621**

**Course Title: Community Service Oriented Project**

|      |                                                                                                                                                                                                                                                                                                  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Social Awareness and Empathy: Engaging in a community service project will help students develop a deeper understanding of social issues and challenges faced by different communities                                                                                                           |
| CO-2 | Active Citizenship and Civic Engagement: Through the community service project, students will learn about the importance of active citizenship and civic responsibility.                                                                                                                         |
| CO-3 | Teamwork and Collaboration: Working on a community service project often involves collaborating with diverse groups of people. Students will learn to work effectively in teams, appreciate diverse perspectives, and leverage collective strengths to achieve common goals.                     |
| CO-4 | Problem-Solving and Project Management: Engaging in a community service project will require students to identify challenges and find solutions. They will develop problem-solving skills and learn project management techniques to plan, implement, and assess the impact of their initiatives |
| CO-5 | Personal Growth and Reflection: The community service project will offer students opportunities for personal growth and self-reflection                                                                                                                                                          |

**Course Code: 19169686**

**Course Title: Soft Skills**

|      |                                           |
|------|-------------------------------------------|
| CO-1 | Effective Communication                   |
| CO-2 | Teamwork and Collaboration                |
| CO-3 | leadership and Emotional Intelligence     |
| CO-4 | Time Management and Organizational Skills |
| CO-5 | Problem-Solving and Critical Thinking     |

**Course Code: 201MM613**

**Course Title: Rock Mechanics Laboratory**

|      |                                                                            |
|------|----------------------------------------------------------------------------|
| CO-1 | Prepare rock samples for testing                                           |
| CO-2 | Comprehend the Physico-MINING properties of rock.                          |
| CO-3 | Determine the methods to measure the different strength parameters of rock |
| CO-4 | Estimate the weathering effects on rock                                    |

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|                                                              |                                                                                                                                                                                                                                      |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-5                                                         | Estimate the drill-ability index of rocks.                                                                                                                                                                                           |
| <b>Course Code: 19160612</b>                                 |                                                                                                                                                                                                                                      |
| <b>Course Title: Mineral Processing Laboratory</b>           |                                                                                                                                                                                                                                      |
| CO-1                                                         | Hands-On Experience with Mineral Processing Equipment: Students will gain practical experience in operating and troubleshooting various mineral processing equipment, such as crushers, screens, grinding mills, and flotation cells |
| CO-2                                                         | Ore Characterization and Analysis: Through laboratory experiments, students will learn to characterize different types of ores                                                                                                       |
| CO-3                                                         | Process Optimization and Control: Students will learn how to optimize mineral processing flowsheets and control the process variables to maximize mineral recovery and concentrate grade                                             |
| CO-4                                                         | Safety and Environmental Awareness: The laboratory exercises will emphasize safety protocols and environmental considerations in mineral processing                                                                                  |
| CO-5                                                         | Data Analysis and Reporting: Students will develop skills in collecting and analyzing experimental data, interpreting results, and preparing comprehensive reports                                                                   |
| <b>Course Outcomes for Fourth Year First Semester Course</b> |                                                                                                                                                                                                                                      |
| <b>Course Code:19160701</b>                                  |                                                                                                                                                                                                                                      |
| <b>Course Title: Mine Legislation and General Safety</b>     |                                                                                                                                                                                                                                      |
| CO-1                                                         | Comprehend the concepts of hazard and disaster management                                                                                                                                                                            |
| CO-2                                                         | Assess the types of hazards and their consequences                                                                                                                                                                                   |
| CO-3                                                         | Comprehend the approaches and measures in disaster management.                                                                                                                                                                       |
| CO-4                                                         | Distinguish various techniques in disaster management                                                                                                                                                                                |
| CO-5                                                         | Comprehend the statutory provisions related to disaster management in India.                                                                                                                                                         |
| <b>Course Code:19160702</b>                                  |                                                                                                                                                                                                                                      |
| <b>Course Title: Mining Machinery</b>                        |                                                                                                                                                                                                                                      |
| CO-1                                                         | Assess air pollution in mines.                                                                                                                                                                                                       |
| CO-2                                                         | Comprehend water pollution in mines.                                                                                                                                                                                                 |
| CO-3                                                         | Appraise the importance of noise pollution in mines.                                                                                                                                                                                 |
| CO-4                                                         | Perform the biological land reclamation                                                                                                                                                                                              |
| CO-5                                                         | Perceive the basic information required for the preparation of environmental impact assessment and environmental management plan.                                                                                                    |
| <b>Course Code: 19160703</b>                                 |                                                                                                                                                                                                                                      |
| <b>Course Title: Computer Applications in Mining</b>         |                                                                                                                                                                                                                                      |
| CO-1                                                         | Summarize the various policies, acts, and conservation rules on minerals                                                                                                                                                             |
| CO-2                                                         | Analyze the mineral taxation laws and pricing mechanism of minerals.                                                                                                                                                                 |
| CO-3                                                         | Interpret various sampling methods                                                                                                                                                                                                   |

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| CO-4                                                                         | Estimate the reserves using various estimation methods.                          |
| CO-5                                                                         | Analyze the mine finance and model optimum size of mine.                         |
| <b>Course Code:19160764A</b>                                                 |                                                                                  |
| <b>Course Title: Mine Construction Engineering (Professional Elective-3)</b> |                                                                                  |
| CO-1                                                                         | Outline the geological investigations in mine.                                   |
| CO-2                                                                         | Comprehend the laying out of shaft lining.                                       |
| CO-3                                                                         | Appraise the design and construction of insets                                   |
| CO-4                                                                         | Comprehend the mechanization of underground operations.                          |
| CO-5                                                                         | Comprehend the mechanization of underground operations                           |
| <b>Course Code: 19160764B</b>                                                |                                                                                  |
| <b>Course Title: Geo statistics (Professional Elective-3)</b>                |                                                                                  |
| CO-1                                                                         | Comprehend the schools of Geo statistics, estimation models for mine evaluation. |
| CO-2                                                                         | Interpret semi-variogram and co-variogram.                                       |
| CO-3                                                                         | Comprehend the extension variance and estimation variance                        |
| CO-4                                                                         | Analyze the integrated geological-geo statistical system                         |
| CO-5                                                                         | Identify the geo statistical applications.                                       |
| <b>Course Code: 19160764C</b>                                                |                                                                                  |
| <b>Course Title: Rock slope Engineering ( Professional Elective-3)</b>       |                                                                                  |
| CO-1                                                                         | Comprehend and analyze the parameters affecting slope stability.                 |
| CO-2                                                                         | Appraise the influence of water on stability of slopes                           |
| CO-3                                                                         | Comprehend and analyze the mechanism of different types of slope failure         |
| CO-4                                                                         | Identify the monitoring and stabilization methods to prevent slope failure.      |
| CO-5                                                                         | Demonstrate the numerical modelling of slope stability                           |
| <b>Course Code: 19160764D</b>                                                |                                                                                  |
| <b>Course Title: Tunnelling Engineering( Professional Elective-3)</b>        |                                                                                  |
| CO-1                                                                         | Appraise tunnelling engineering in underground openings.                         |
| CO-2                                                                         | Comprehend and analyze the mechanism of tunnelling engineering                   |
| CO-3                                                                         | Identify various drilling and blasting methods used in tunnel engineering        |
| CO-4                                                                         | Identify different equipment used in tunnel engineering.                         |
| CO-5                                                                         | Design the support systems in tunnel engineering.                                |

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**Course Code: 19160764E**

**Course Title: . Mine Safety Engineering (Professional Elective-5)**

|      |                                                                                 |
|------|---------------------------------------------------------------------------------|
| CO-1 | Outline typical accidents prone to occur in mines.                              |
| CO-2 | Analyse various accidents associated with mining works.                         |
| CO-3 | Comprehend about statutory safety requirements in mines.                        |
| CO-4 | Summarize safety and risk management practices in mines.                        |
| CO-5 | Infer typical miners' health issues, occupational diseases and their prevention |

**Course Code: 19169765g**

**Course Title: . Total Quality Management (open Elective-4)**

|      |                                                                                                                                                                             |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | Understanding Total Quality Management (TQM) Principles                                                                                                                     |
| CO-2 | Implementation of Quality Systems                                                                                                                                           |
| CO-3 | Quality Control and Assurance in Mining                                                                                                                                     |
| CO-4 | Safety and Environmental Considerations                                                                                                                                     |
| CO-5 | Leadership and Change Management: Students will develop leadership skills and an understanding of change management principles in the context of implementing TQM in mining |

**Course Code: 19160711**

**Course Title: Computer applications in mining laboratory**

|      |                                                                |
|------|----------------------------------------------------------------|
| CO-1 | Comprehend the usage of software in various mining operations. |
| CO-2 | Design pillars, dumps and slopes using numerical modeling..    |
| CO-3 | Comprehend the concepts of CPM/ PERT and blast optimization.   |
| CO-4 | Plan and design open cast and underground mines.               |
| CO-5 | Comprehend the usage of software in various mining operations. |

**Course Code: 19160712**

**Course Title: Mining Machinery Laboratory**

|      |                                                        |
|------|--------------------------------------------------------|
| CO-1 | Identify various wire ropes used in mines              |
| CO-2 | Plan transport systems and safety devices              |
| CO-3 | Demonstrate gate end box and various cables used mines |
| CO-4 | Plan and design different types of support systems     |
| CO-5 | Distinguish different types of support systems         |

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**Course Code: 201MM763D**

**Course Title: Mine Valuation (Professional Elective-5)**

|      |                                                              |
|------|--------------------------------------------------------------|
| CO-1 | Appraise the economic importance of mineral industry.        |
| CO-2 | Distinguish the various methods of mine valuation            |
| CO-3 | Evaluate the economic feasibility of a mining project.       |
| CO-4 | Summarize the methods of project evaluation.                 |
| CO-5 | Infer various sources of mine fund and cost control methods. |

**Course Code: 19160721**

**Course Title: Mini project 2/ summer internship**

|      |                                                                                                                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO-1 | In-Depth Application of Mining Engineering Principles: Students will demonstrate a comprehensive understanding of mining engineering concepts and principles acquired throughout their B.Tech program. |
| CO-2 | Project Planning and Management: Through the final project, students will gain experience in project planning and management                                                                           |
| CO-3 | Practical Problem-Solving Skills: The final project will require students to identify, analyze, and solve complex mining engineering problems                                                          |
| CO-4 | Research and Data Analysis: Students will conduct in-depth research on their chosen mining engineering topic and use data analysis techniques to draw meaningful conclusions.                          |
| CO-5 | Technical Communication and Presentation: The final project will enhance students' technical communication and presentation skills.                                                                    |

**Course Outcomes for Fourth Year Second Semester Course**

**Course Code: 19160861A**

**Course Title: Planning of Underground Metal Mines (Professional Elective-4)**

|      |                                                                   |
|------|-------------------------------------------------------------------|
| CO-1 | Plan and schedule the working of an Underground metal mine.       |
| CO-2 | Comprehend and drive levels                                       |
| CO-3 | Analyze underground metal mining equipment selection & support    |
| CO-4 | Demonstrate the transportation system in underground metal mines. |
| CO-5 | Design the layouts of working of underground metal mines.         |

**Course Code: 19160861B**

**Course Title: Mine Management (Professional Elective-4)**

|      |                                                                     |
|------|---------------------------------------------------------------------|
| CO-1 | Comprehend and practice mine management.                            |
| CO-2 | Appraise the importance of personal management and human relations. |
| CO-3 | Perform work study environment and comprehend operation management. |
| CO-4 | Outline the concepts of behavioural sciences for management.        |

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|                                                                                   |                                                                                                                                   |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| CO-5                                                                              | Comprehend the principles of maintenance and marketing management.                                                                |
| <b>Course Code:19160861C</b>                                                      |                                                                                                                                   |
| <b>Course Title: Mine Subsidence Engineering (Professional Elective-4)</b>        |                                                                                                                                   |
| CO-1                                                                              | Comprehend and analyze the subsidence mechanism.                                                                                  |
| CO-2                                                                              | Outline the different methods of subsidence prediction.                                                                           |
| CO-3                                                                              | Assess the time influence of subsidence and impact on structures.                                                                 |
| CO-4                                                                              | Summarize the effects of subsidence.                                                                                              |
| CO-5                                                                              | Outline the methods to control subsidence.                                                                                        |
| <b>Course Code:19160861D</b>                                                      |                                                                                                                                   |
| <b>Course Title: Dimensional Stone Mining(Professional Elective-4)</b>            |                                                                                                                                   |
| CO-1                                                                              | Comprehend the concept of dimensional stone mining.                                                                               |
| CO-2                                                                              | Analyze the different methods of dimensional stone mining                                                                         |
| CO-3                                                                              | Identify the various equipment used in dimensional stone mining.                                                                  |
| CO-4                                                                              | Assess the different environmental issues.                                                                                        |
| CO-5                                                                              | Summarize the applications of dimensional stone mining                                                                            |
| <b>Course Code:19160861E</b>                                                      |                                                                                                                                   |
| <b>Course Title: Environmental Management in Mines(Professional Elective-4)</b>   |                                                                                                                                   |
| CO-1                                                                              | Outline the environmental issues in mineral industry                                                                              |
| CO-2                                                                              | Interpret the air and water pollution in mines.                                                                                   |
| CO-3                                                                              | Assess the importance of noise pollution in mines.                                                                                |
| CO-4                                                                              | Comprehend and analyse the biological land reclamation.                                                                           |
| CO-5                                                                              | Perceive the basic information required for the preparation of environmental impact assessment and environmental management plan. |
| <b>Course Code:19160862A</b>                                                      |                                                                                                                                   |
| <b>Course Title: Open Pit Slope Analysis and Design (Professional Elective-5)</b> |                                                                                                                                   |
| CO-1                                                                              | Classify various modes of slope failure.                                                                                          |
| CO-2                                                                              | Comprehend and analyse the geotechnical parameters required for slope stability analysis.                                         |
| CO-3                                                                              | Interpret the shear strength of intact rock mass and jointed rock mass.                                                           |
| CO-4                                                                              | Analyse the flow of water in slope stability.                                                                                     |
| CO-5                                                                              | Summarize various methods and techniques used to assess the slope stability.                                                      |

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**Course Code:19160862B**

**Course Title: Waste Management (Professional Elective-5)**

|      |                                                                           |
|------|---------------------------------------------------------------------------|
| CO-1 | Identify the collection systems of solid waste of a town.                 |
| CO-2 | Design and plan municipal solid waste treatment and landfill              |
| CO-3 | Identify the criteria for selection of landfill                           |
| CO-4 | Analyze the solid waste and design a composting facility                  |
| CO-5 | Demonstrate the different processing and treatment techniques of tailings |

**Course Code:19160862C**

**Course Title: Rock Fragmentation Engineering(Professional Elective-5)**

|      |                                                                          |
|------|--------------------------------------------------------------------------|
| CO-1 | Comprehend the concept of rock breaking theory.                          |
| CO-2 | Comprehend and analyze the mechanism of different types of rock drilling |
| CO-3 | Analyze the mechanism of rock fragmentation.                             |
| CO-4 | Comprehend the techniques of the blast design.                           |
| CO-5 | Outline the techniques of controlled blasting                            |

**Course Code:19160862D**

**Course Title: Deep Sea Mining(Professional Elective-5)**

|      |                                                                                                 |
|------|-------------------------------------------------------------------------------------------------|
| CO-1 | Comprehend the process of mining of shallow and deep-sea mineral resources.                     |
| CO-2 | Analyze the profile of sea with the mineral deposits.                                           |
| CO-3 | Comprehend and predict the nature of continental shelf, slope sea floor, and mining conditions. |
| CO-4 | Comprehend and Analyze the production of oil and natural gas from sea mining                    |
| CO-5 | Outline the environmental impacts of deep-sea mining                                            |

**Course Code:19160862E**

**Course Title: Mine Hazards and Rescue (Professional Elective-5)**

|      |                                                                                |
|------|--------------------------------------------------------------------------------|
| CO-1 | Outline the techniques to control spontaneous heating and mine fires in mines. |
| CO-2 | Comprehend the techniques to prevent explosion                                 |
| CO-3 | Comprehend and analyze the techniques to prevent inundation in mines           |
| CO-4 | Summarize the techniques of mine rescue and recovery work                      |
| CO-5 | Outline the different methods of mine illumination                             |

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**Course Code:19160841**

**Course Title : Project work**

|      |                                                                                                  |
|------|--------------------------------------------------------------------------------------------------|
| CO-1 | In-Depth Application of Mining Engineering Principles: Students will demonstrate a comprehensive |
|------|--------------------------------------------------------------------------------------------------|



|      |                                                                                                                                                                               |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | understanding of mining engineering concepts and principles acquired throughout their B.Tech program.                                                                         |
| CO-2 | Project Planning and Management: Through the final project, students will gain experience in project planning and management                                                  |
| CO-3 | Practical Problem-Solving Skills: The final project will require students to identify, analyze, and solve complex mining engineering problems                                 |
| CO-4 | Research and Data Analysis: Students will conduct in-depth research on their chosen mining engineering topic and use data analysis techniques to draw meaningful conclusions. |
| CO-5 | Technical Communication and Presentation: The final project will enhance students' technical communication and presentation skills.                                           |



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