



ADITYA ENGINEERING COLLEGE

An Autonomous Institution

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Department of Electronics and Communication Engineering

B.Tech - AR19 - Course Articulation Matrix

Note: Correlation Levels are 1 or 2 or 3. Where 1- Slight(Low), 2 - Moderate(Medium), 3 - Substantial (High).

| | CO Statements | | | | POs | | | | | | | | | | PSOs | | | |
|--------------------|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|------|------|------|
| Course Code | CO1 | CO2 | CO3 | CO4 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | Explain the basic concepts of Semi-Conductors and Identify the type of semiconductors using Hall Effect. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | Explain about magnetic and dielectric properties of different materials. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Course Code | 191ES1T01 - PROGRAMMING FOR PROBLEM SOLVING USING C | | | | | | | | | | | | | | | | | |
| | Illustrate the fundamental concepts of computers and basics of computer programming | 2 | 3 | - | - | 1 | - | - | - | - | - | - | - | - | 2 | - | - | |
| | Make use of control structures and arrays in solving complex problems. | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 2 | - | - | |
| | Develop modular program aspects and strings fundamentals | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| | Demonstrate the ideas of pointers usage. | 2 | 3 | - | - | 2 | - | - | - | - | - | - | - | - | 2 | - | - | |
| | Solve real world problems using the concept of structures, unions and File operations. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - | |
| Course Code | 191HS1L01 - COMMUNICATIVE ENGLISH LAB-I | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| | Make use of the concepts to communicate confidently and competently in English Language in all spheres. | - | - | - | - | 1 | - | - | - | - | 5 | - | - | 1 | - | - | - | |
| | Express Creative skills to construct Dialogues / Conversations in Spoken and Written forms. | - | - | - | - | 1 | - | - | - | - | 5 | - | - | 2 | - | - | - | |
| | Identify Accent for intelligibility. | - | - | - | - | 1 | - | - | - | - | 5 | - | - | 2 | - | - | - | |
| | Demonstrate communicative ability in everyday Conversation, JAM Sessions and Public Speaking. | - | - | - | - | 1 | - | - | - | - | 5 | - | - | 1 | - | - | - | |
| | Demonstrate nuances of Language through Audio – Visual Experience and group activities. | - | - | - | - | 1 | - | - | - | - | 5 | - | - | 1 | - | - | - | |
| Course Code | 191BS1L03 -APPLIED PHYSICS LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| | Use spectrometer, travelling microscope for making measurements. | 3 | 2 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | |
| | Determine energy gap of a semiconductor, draw characteristic curves to estimate thermal coefficient of a thermistor, Zener diode. | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | |
| | Determine the dielectric constant and resistivity. | 3 | 1 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | |
| | Determine wavelength of source and width of the narrow slits. | 3 | 2 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | |
| | Find the strength of magnetic field. | 3 | 2 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | |
| Course Code | 191ES1L01 - PROGRAMMING FOR PROBLEM SOLVING USING C LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| | Develop the basic programs in C and draw the flowcharts using Raptor | 2 | 1 | - | - | 3 | - | - | - | - | 2 | - | - | - | - | - | - | |
| | Make use of conditional and iterative statements to solve real time scenarios in C | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - | |
| | Apply the concept of arrays, modularity and strings to handle complex problems. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - | |
| | Apply the dynamic memory allocation functions using pointers | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO5 | Compute the Z- transforms for certain functions and apply the properties of Z-transforms to solve difference equations. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191BS2T09 -ENGINEERING CHEMISTRY | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Compare the quality of drinking water and problems associated with hard water | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Explain the fundamentals and applications of Electrochemical Energy Systems. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Explain the fundamentals and applications of Advance materials. | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain about renewable energy sources and their manufacturing methods | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Summarize the importance of Nano materials and Green chemistry. | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ES2T02- ENGINEERING GRAPHICS AND DESIGN | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Make use of fundamentals of Engineering Drawing to sketch basic curves, conic sections, cycloid, epicycloid, hypocycloid and involute | 1 | - | - | - | - | - | - | - | - | 1 | - | 1 | 1 | - |
| CO2 | Apply the principles of orthographic projections for points, lines and planes. | 1 | - | - | - | - | - | - | - | - | 1 | - | 1 | 1 | - |
| CO3 | Apply the principles of orthographic projections for solids. | 1 | - | - | - | - | - | - | - | - | 1 | - | 1 | 1 | - |
| CO4 | Apply the AutoCAD software for the orthographic projection of the machine parts. | 1 | - | - | - | 3 | - | - | - | - | 1 | - | 1 | 1 | - |
| CO5 | Apply the AutoCAD software for the isometric projection of the machine parts. | 1 | - | - | - | 3 | - | - | - | - | 1 | - | 1 | 1 | - |
| Course Code | 191ES2T07-BASIC ELECTRICAL ENGINEERING | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain about the working principle of DC Motor. | 2 | 1 | - | 2 | - | - | - | - | - | - | 1 | - | - | - |
| CO2 | Summarize the working principle of DC generator. | 2 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO3 | Explain the working and construction of single phase transformer, efficiency and regulation using OS and SC test. | 2 | 1 | - | - | - | - | 3 | - | - | - | 2 | - | - | - |
| CO4 | Explain the working of three phase induction motor, efficiency and starting methods | 2 | 1 | - | - | - | - | 3 | - | - | - | 2 | - | - | - |
| CO5 | Analyze the basic principle of single phase induction motor using double field revolving theory and cross field theory | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | Analyze the concept of special electrical machines. | 2 | 1 | - | - | - | - | 3 | - | - | - | - | - | - | - |
| Course Code | 191ES2T08-NETWORK ANALYSIS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Analyze circuits using direct application of Kirchoffs Current and Voltage laws along with Ohms Law. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO2 | Apply phasor analysis to AC circuits in sinusoidal steady state. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 3 | - |
| CO3 | Interpret the significance of resonant and non-resonant circuits | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |

| | CO Statements | | | | POs | | | | | | | | | | PSOs | | | |
|--|--|---|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Course Code | 191HS2L02-COMMUNICATIVE ENGLISH LAB-II | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO4 | Analyze circuits using network theorems. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | - | |
| CO5 | Explain parameters of two-port networks. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - | |
| CO6 | Apply transient conditions for any first order and second order systems. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 3 | - | |
| Course Code 191BS2L04 - ENGINEERING CHEMISTRY LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | Demonstrate Acid – Complexometric titrations by volumetric analysis. | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | - | 1 | - | - | |
| CO2 | Demonstrate Acid – Base titrations by instrumental analysis. | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | - | 1 | - | - | |
| CO3 | Estimate Vitamin C using volumetric analysis | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | - | 1 | - | - | |
| CO4 | Prepare polymer like Bakelite. | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | - | 1 | - | - | |
| CO5 | Prepare alternative fuel like Bio-Diesel. | 2 | - | - | - | - | - | - | 1 | - | 1 | 1 | - | - | 1 | - | - | |
| Course Code 191ES2L08-BASIC ELECTRICAL ENGINEERING LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | Demonstrate the concept of resonance of series and parallel RLC circuit. | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| CO2 | Calculate parameters of two port network. | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| CO3 | Perform various network thermos on given networks. | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| CO4 | Compute various characteristics of DC shunt motor, and 3 phase induction motor | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| CO5 | Calculate the efficiency and regulation of single phase transformer. | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| CO6 | Perform various speed control methods on DC motor | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | |
| Course Code 191ES2L09-ELECTRONICS ENGINEERING WORKSHOP | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | Find the values of Resistance /inductance / capacitance & tolerances by using colour coding. | 3 | - | - | - | - | - | - | - | - | 2 | - | - | 1 | 1 | - | | |
| CO2 | Demonstrate the use of Analog Electronic Circuit development system for construction of a circuit. | 3 | - | - | - | - | - | - | - | - | 2 | - | - | 1 | 2 | - | | |
| CO3 | Use testing and measuring instruments for different applications. | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | 1 | 3 | - | | |
| CO4 | Design PCBs for simple applications. | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | 1 | 3 | - | | |
| CO5 | Select batteries and solar panels for different applications. | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | 1 | 3 | - | | |
| CO6 | Identify various hardware parts of a computer. | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | 1 | 3 | - | | |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191PR2P01 - ENGINEERING EXPLORATION PROJECT | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Analyze the surrounding environment and identify a design challenge | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO2 | Foster team collaboration, find inspiration from the environment and learn how to identify problems | - | 1 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | Encourage exploration to process the Design Challenge, empathize & brainstorm the users effectively | - | - | 1 | 1 | - | 1 | 1 | - | - | - | - | - | - | - |
| CO4 | Build effective prototypes as tangible models to use as communication tools | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | Test the prototype for design challenge and submit the report adhering to professional ethics | - | - | - | - | 1 | - | - | 1 | - | - | - | 1 | 1 | - |
| III SEM | | | | | | | | | | | | | | | |
| Course Code | 191BS3T13- NUMERICAL METHODS & VECTOR CALCULUS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Apply numerical methods to solve equations and interpolation of polynomials. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Apply numerical methods to initial value problems and problems involving integration. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Compute double integral over a region and triple integral over a volume. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Compute the gradient of a scalar function, divergence and curl of a vector function. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Apply line, surface and volume integrals. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ES3T12-RANDOM VARIABLES AND STOCHASTIC PROCESSES | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Summarize the characteristics of standard random variables. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | Compare the random variables with respect to moments. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | Develop multiple random variable with the help of single random variable. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | Categorize the random processes in time domain. | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO5 | Analyze the LTI system response with random inputs. | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| Course Code | 191HS3T02-MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the Managerial Economic concepts for decision making and forward planning. | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 |
| CO2 | Illustrate the law of demand and its exceptions by using different forecasting methods. | - | - | - | - | - | - | - | - | - | 2 | - | - | - | 1 |
| CO3 | Apply the production and cost concepts to determine Break Even Point in managerial decision areas. | - | - | - | - | - | - | - | - | - | - | 3 | - | - | 1 |
| CO4 | Classify different types of Market structures and business organizations. | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 |

| | CO Statements | | | | POs | | | | | | | | | | PSOs | | | |
|-------------|---|---------|-------------|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|------|
| | CO5 | CO6 | Course Code | 191EC3T01-ELECTRONIC DEVICES AND CIRCUITS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO5 | Prepare final accounts by using process and principles of accounting. | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 1 | |
| CO6 | Utilize various techniques on investment project proposals with the help of capital budgeting techniques for decision making. | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 2 | |
| Course Code | 191EC3T01-ELECTRONIC DEVICES AND CIRCUITS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Interpret the characteristics of semiconductor diodes. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO2 | Compare the characteristics of rectifiers with and without filters. | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO3 | Summarize the characteristics of BJT and FET in different configurations. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| CO4 | Apply biasing methods for stabilization of BJT and FET amplifiers. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| CO5 | Interpret small signal low frequency equivalent models of BJT and FET. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| Course Code | 191EC3T02-DIGITAL ELECTRONICS AND LOGIC DESIGN | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Interpret numeric information in different code formats. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| CO2 | Develop optimized logic by using various optimization algorithms. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO3 | Design various combinational logic circuits for required specifications. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO4 | Design different sequential logic circuits for required specifications. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO5 | Evaluate different Finite State Machines (FSMs). | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| Course Code | 191EC3T03-SIGNALS AND SYSTEMS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Interpret numeric information in different code formats. | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | | |
| CO2 | Develop optimized logic by using various optimization algorithms. | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - | | |
| CO3 | Design various combinational logic circuits for required specifications. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO4 | Design different sequential logic circuits for required specifications. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| CO5 | Evaluate different Finite State Machines (FSMs). | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | - | | |
| Course Code | 191EC3L01-ELECTRONIC DEVICES AND CIRCUITS LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Examine the functional characteristics of semiconductor devices. | 2 | 1 | - | - | - | - | - | - | 2 | 1 | - | - | - | 2 | - | | |
| CO2 | Design rectifier and regulator circuits using basic semiconductor devices. | 3 | 2 | - | - | - | - | - | - | 2 | 1 | - | - | - | 3 | - | | |
| CO3 | Examine the characteristics of transistor in different configurations. | 3 | 2 | - | - | - | - | - | - | 2 | 1 | - | - | - | 3 | - | | |
| CO4 | Analyze the frequency response of small signal low frequency amplifiers. | 2 | 2 | - | - | - | - | - | - | 2 | 1 | - | - | - | 3 | - | | |
| CO5 | Describe the behavior of negative resistance devices. | 2 | 2 | - | - | - | - | - | - | 2 | 1 | - | - | - | 2 | - | | |
| Course Code | 191ES3L16-DIGITAL ELECTRONICS AND LOGIC DESIGN LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Choose an appropriate logic gate for the design of digital circuits. | 3 | 2 | - | - | - | - | - | - | 2 | - | - | - | 1 | 3 | - | | |
| CO2 | Develop circuits to verify Boolean theorem's | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | 1 | 2 | - | | |
| CO3 | Construct combinational logic circuits. | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | 1 | 3 | - | | |
| CO4 | Interpret the behavior of flip-flops for different combination of inputs. | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | 1 | 3 | - | | |
| CO5 | Build registers and counters using flip flops. | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | 1 | 2 | - | | |
| Course Code | 191MC3A03-EMPLOYABILITY SKILLS-I | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | | |
| CO1 | Solve problems of Series & Analogy for Numbers and Letters | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | | |
| CO2 | Solve problems on Coding & Decoding and Divisibility rules | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | | |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO5 | Summarize the performance metrics of power amplifiers. | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO6 | Select the appropriate tuned amplifier circuit to build a given application. | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | 2 | - |
| Course Code | 191EC4T05-ELECTROMAGNETIC WAVES AND TRANSMISSION LINES | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Interpret the fundamental concepts of transmission lines. | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | Apply various impedance matching techniques for the setup of transmission lines. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | Infer the Maxwell's equations for static electric and magnetic fields. | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | Analyze the time varying behavior of electric and magnetic fields by applying the Maxwell's equations. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO5 | Analyze the propagation, reflection and transmission of uniform plane waves in different media. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| Course Code | 191EC4T06-MICROPROCESSORS AND MICROCONTROLLERS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Illustrate the basic concepts of microprocessors. | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 3 |
| CO2 | Explain the assembly language programming concepts of 8086 microprocessors. | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO3 | Demonstrate the basic concepts of interfacing memory and peripheral devices to a microprocessor. | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO4 | Apply the knowledge of instruction set to write 8051 microcontroller based programs. | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO5 | Explain the interfacing concepts of 8051 microcontrollers | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| Course Code | 191EC4T07-ANALOG COMMUNICATIONS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Compare the linear modulation and demodulation techniques. | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | Illustrate the concepts of generation and detection of angle modulated signals. | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | Interpret the functionalities of AM and FM transmitters and receivers. | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | Illustrate noise performance in linear and angle modulation techniques. | 2 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | - |
| CO5 | Describe the generation and detection of pulse analog modulated signals. | 2 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | - |
| Course Code | 191EC4L02-ANALOG ELECTRONIC CIRCUITS LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Determine the frequency response, impedance and Q-point of different types of multi stage amplifiers. | 3 | 2 | - | - | 1 | - | - | - | 2 | - | - | - | 3 | - |
| CO2 | Construct voltage and current feedback amplifiers for given specifications. | 3 | 2 | - | - | 1 | - | - | - | 1 | - | - | - | 2 | - |
| CO3 | Analyze LC and RC types of oscillators for given specifications. | 2 | 3 | - | - | 2 | - | - | - | 2 | - | - | - | 3 | - |
| CO4 | Analyze the efficiency of class A power amplifier for given specifications. | 2 | 1 | - | - | - | - | - | - | 2 | - | - | - | 2 | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | | | |
|-------------|---|--|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Course Code | CO6 | Explain different object color modeling techniques, Fractals and Ray tracing concepts. | 3 | 2 | - | - | - | - | - | - | - | - | - | | | | |
| | 191MI5O01-OVERVIEW OF MINING (OPEN ELECTIVE- I) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | | |
| | CO1 | Analyze different stages in the life of a mine. | 1 | - | - | - | - | 1 | 1 | - | - | - | - | - | - | | |
| | CO2 | Choose a suitable location for opening to a deposit. | 1 | - | - | - | - | 1 | 1 | - | - | - | - | - | - | | |
| | CO3 | Organize for building appropriate permanent lining, drift with proper ventilation and lighting arrangements. | 1 | - | - | - | - | 1 | 1 | - | - | - | - | - | - | | |
| | CO4 | Select the special methods need to be adopted for a particular situation. | 1 | 3 | - | - | - | 1 | 1 | - | - | - | - | - | - | | |
| | CO5 | Explain the impact of mining activities on environment | 1 | 3 | - | - | - | 1 | 1 | - | - | - | - | - | - | | |
| Course Code | 191PT5O01-PROCESS INTENSIFICATION IN PETROLEUM INDUSTRY (OPEN ELECTIVE- I) | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Explain the basic principles and mechanisms that are responsible for process intensification. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO2 | Analyze various modifications to process equipment and designs with which process intensification becomes a reality in unit operations and unit processes. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO3 | Analyze various case studies available in petrochemical, fine chemical, bioprocesses for Downhole separation | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO4 | Explain the role of photo voltaic cells, solar power in offshore oil and gas operations. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO5 | Apply the working principles of Divided wall distillation for separation of natural gas -liquid | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Course Code | 191PT5O02 - FUNDAMENTALS OF PETROLEUM INDUSTRY (OPEN ELECTIVE- I) | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Apply the basic principles and mechanisms that are responsible for petroleum industry. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO2 | Analyze various modifications to equipment and designs with which evaluate the lithological characteristics and behavior of reservoir. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO3 | Explain the hydro carbon activity in reservoir, logging, testing and completion. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO4 | Analyze various case studies available in petrochemical, chemical, bioprocesses for treatment of wastage. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | CO5 | Analyze various modifications to well for better production rate. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Course Code | 19AG5O01-BASIC CROP PRODUCTION PRACTICES (OPEN ELECTIVE- I) | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Explain factors affecting on crop growth and production. | 1 | 1 | - | - | 1 | - | - | - | - | - | - | 2 | - | - | |

| | CO Statements | | | | POs | | | | | | | | | | PSOs | | | |
|-------------|--|--|--|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO2 | Explain crop selection and establishment of an adequate crop stand and ground cover. | | | | 1 | - | - | - | 2 | - | - | - | - | - | - | - | - | |
| CO3 | Explain crop water management using integrated water management methods. | | | | 1 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | |
| CO4 | Apply agricultural crops production practices in field. | | | | 1 | - | 1 | 1 | 3 | - | - | - | - | - | - | - | - | |
| CO5 | Apply the horticulture crops production practices in field. | | | | 1 | - | 1 | 1 | 3 | - | - | - | - | - | - | 2 | - | |
| Course Code | 191EC5L05-INTEGRATED CIRCUITS AND APPLICATIONS LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Experiment with Op-Amp circuits for linear and non linear applications with the given specifications | | | | 3 | 2 | 2 | - | - | - | - | - | 2 | - | - | - | 3 | - |
| CO2 | Design Butterworth filters using Op-Amps with given specification. | | | | 2 | 2 | 1 | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO3 | Design Waveform Generator using IC555 with variable duty cycle. | | | | 2 | 2 | 2 | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO4 | Evaluate Capture and Lock range using PLL. | | | | 2 | 2 | 1 | - | - | - | - | - | 2 | - | - | - | 3 | - |
| CO5 | Design Dual Power Supply using 78XX and 79XX. | | | | 2 | 2 | 1 | - | - | - | - | - | 2 | - | - | - | 2 | - |
| Course Code | 191EC5L06-DIGITAL COMMUNICATIONS LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Examine Time Division Multiplexing and Demultiplexing | | | | 3 | 2 | - | - | 1 | - | - | - | 1 | - | - | - | 3 | - |
| CO2 | Analyze digital baseband modulation techniques. | | | | 3 | 1 | - | - | 1 | - | - | - | 1 | - | - | - | 3 | - |
| CO3 | Experiment with various digital carrier modulation schemes | | | | 2 | 1 | - | - | 2 | - | - | - | 1 | - | - | - | 3 | - |
| CO4 | Measure the efficiency of the source coding techniques. | | | | 2 | 2 | - | - | 2 | - | - | - | 1 | - | - | - | 2 | - |
| CO5 | Examine different error control coding schemes. | | | | 2 | 1 | - | - | 1 | - | - | - | 1 | - | - | - | 2 | - |
| Course Code | 191HS5T06-EMPLOYABILITY SKILLS-III | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain different types of puzzles, group reasoning, clock and calendar problems | | | | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO2 | Solve problems on cubes & dice, partnership, percentages. | | | | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO3 | Solve problems on profit and loss, simple interest and compound interest | | | | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO4 | Apply interviewing skills, Group discussion skills and personal priorities | | | | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO5 | Apply resume writing skills, e-mail writing & business etiquette | | | | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| Course Code | 191PR5P02-SOCIALLY RELEVANT PROJECT | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Conduct a literature survey in the selected area | | | | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | 1 | - |
| CO2 | Use scientific reasoning to gather, evaluate and interpret the survey data to identify the problem | | | | - | 2 | - | - | - | 2 | 2 | - | - | - | - | 2 | 1 | - |
| CO3 | Design and develop many solutions in the light of societal, cultural, legal and environmental issues | | | | - | - | 2 | 2 | - | - | - | 1 | - | - | - | - | 2 | - |
| CO4 | Select a final solution to the social problem and submit as a working prototype | | | | - | - | - | 2 | - | - | - | - | - | - | - | - | 1 | - |
| CO5 | Use modern tools to prepare the results of the project as a report adhering to professional ethics | | | | - | - | - | - | 2 | - | - | 2 | - | - | 1 | 1 | 1 | 1 |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|--------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191MC5A08-INTELLECTUAL PROPERTY RIGHTS AND PATENTS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Compare various types of Intellectual Property rights. | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - |
| CO2 | Discuss Intellectual Property and infer rights on such Intellectual Property owners | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - |
| CO3 | Explain the process of patenting | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - |
| CO4 | Apply for trade marks and trade secrets. | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - |
| CO5 | Interpret the legal issues on Intellectual Property Rights and cyber laws | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - |
| VI Semester | | | | | | | | | | | | | | | |
| Course Code | 191EC6T12-INTERNET OF THINGS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the basic building blocks of IoT. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | Make use of the features provided by the Arduino & RaspberryPi IDEs and develop basic programming. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | Explain various sensors and actuators used in IoT. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO4 | Outline the protocols for device and cloud connectivity in IoT. | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO5 | Demonstrate the case studies of IoT applications | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| Course Code | 191EC6T12-VLSI DESIGN | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Outline the fundamental concepts related to MOS and Bi-CMOS Circuits fabrication | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | - |
| CO2 | Analyze the electrical properties of MOS and BiCMOS Circuits. | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | Make use of design rules for stick and layout diagrams. | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 2 | - |
| CO4 | Construct alternative forms of loads towards effective performance by subsystems | 1 | 1 | 3 | - | - | - | - | - | - | - | - | 1 | 1 | - |
| CO5 | Interpret FPGA and ASIC design approaches for semi custom design. | 1 | 1 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| Course Code | 191EC6T14-DIGITAL SIGNAL PROCESSING | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Analyze Discrete Time Signals and Systems. | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | Apply various DFT properties to evaluate the given sequence. | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | Make use of FFT Algorithms for the computation of DFT. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | Design digital filters and implement with different structures. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | - |
| CO5 | Apply the knowledge of Multirate signal processing in the real time applications | 2 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | - |
| Course Code | 191EC6E07-INFORMATION THEORY AND CODING (PROFESSIONAL ELECTIVE - II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the basic concepts of information, Entropy, and Source coding. | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | Calculate the mutual information and channel capacity. | 2 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | Develop the linear block codes for the given data. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | - |
| CO4 | Develop the cyclic codes and BCH codes for the given data. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | CO3 Explain the hazard assessment and mitigation measures CO4 Explain landslides and earthquake disasters and management CO5 Explain about cyclone, fire disasters and rehabilitation programmes | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191EE6004-ENERGY AUDIT AND CONSERVATION MANAGEMENT (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain energy efficiency, conservation and various technologies. | 2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | Design energy efficient lighting systems. | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO3 | Calculate power factor of systems and propose suitable compensation techniques. | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain energy conservation in HVAC systems. | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | Calculate life cycle costing analysis and return on investment on energy efficient technologies. | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191EE6005-NON CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the prospects of renewable energy and solar energy. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO2 | Apply the knowledge of solar principles for its applications. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO3 | Discuss the working principles of wind and Bio-mass energy resources. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO4 | Illustrate the techniques and conversion principles of Geothermal and tidal energy resources. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO5 | Explain the concept of Direct energy conversion | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| Course Code | 191EE6006-INSTRUMENTATION (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain various types of signals | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | Explain various types of Transducers principles | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO3 | Measure various parameters such as strain, velocity, temperature, pressure etc. | 2 | 1 | 1 | 3 | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain the working principle of various types of digital Voltmeters and measure various parameter like phase and frequency of a signal with the help of CRO. | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | Analyze the different signals using various types of signal analyzers | 1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ME6006-SOLAR ENERGY UTILISATION (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the concept of solar radiation and its measurement. | 1 | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - |
| CO2 | Describe the working principle of different types of collector and its types. | 2 | - | - | - | - | 2 | 1 | - | - | - | - | 2 | - | - |
| CO3 | Explain the various solar thermal energy technologies and their applications | 2 | - | - | - | - | 2 | 1 | - | - | - | - | 2 | - | - |
| CO4 | Analyze the various solar PV cell materials and conversion techniques. | 2 | - | - | - | - | 1 | 1 | - | - | - | - | 2 | - | - |
| CO5 | Apply solar passive building techniques for cooling and heating applications | 2 | - | - | - | - | 1 | 1 | - | - | - | - | 2 | - | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191ME6O07-BASIC THERMODYNAMICS AND HEAT TRANSFER (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain basic thermodynamic concepts and laws of thermodynamics | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Make use of steam tables to solve problems on properties of pure substance and gas mixture | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Find the efficiency of a thermodynamic cycle | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain basic heat transfer mechanisms | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Evaluate the performance of heat exchangers | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ME6O08-INTRODUCTION TO HYDRAULICS AND PNEUMATICS (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Describe the fundamentals of fluid power systems. | 1 | 1 | 1 | - | - | - | 3 | - | - | - | - | - | - | - |
| CO2 | Illustrate the working of fluid power actuators, hydraulic motors, and Hydraulic components. | 1 | 1 | 1 | - | - | - | 3 | - | - | - | - | - | - | - |
| CO3 | Analyze the concepts of hydraulic circuits. | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain the working of pneumatic systems. | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Examine the concepts of pneumatic circuits. | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ME6O09-3D PRINTING (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Summarize the basics of AM technologies. | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| CO2 | Explain about vat photo polymerization, material jetting and binder jetting AM technologies. | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| CO3 | Explain material extrusion and sheet lamination AM technologies. | 1 | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - |
| CO4 | Illustrate powder bed fusion and directed energy deposition AM technologies. | 1 | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - |
| CO5 | Apply the AM techniques in different industries | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| CO6 | Select AM technologies using decision methods | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| Course Code | 191ME6O10-ROBOTICS (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the basic concepts, parts of robots and types of robots. | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | Identify various robot configuration and components, | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | Select appropriate actuators and sensors for a robot based on specific application | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | Analyze the simple serial kinematic chains | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | Analyze the trajectory planning for a manipulator by avoiding Obstacles | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Course Code | 191ME6O11-MANAGEMENT SCIENCE (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Apply management and motivation theories to renovate the practice of management. | 1 | 1 | - | - | - | 1 | | - | - | - | - | 1 | - | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | CO4 Assess and minimize the risk using safety analysis techniques | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| | CO5 Explain Safety standards, safety information system and safety audit | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| Course Code | 191MI6O03-ELECTRICAL EQUIPMENT'S IN MINES (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain about power systems used in mines. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Analyze various earthing methods used in mines. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Summarize various electrical equipment used in mines. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain the instrumentation and control systems used in mines | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Analyze about mine telephone system and intrinsic safety. | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191PT6O03-UNCONVENTIONAL HYDROCARBON RESOURCES (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Outline the fundamentals of Coal Bed Methane | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Estimate the shale gas reserves for Indian Scenario | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Determine the extent of gas hydrates resource estimation | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Illustrate the Origin and Characterize Shale Gas. | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Explain the Heavy oil reservoirs and their Challenges | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191PT6O04-ASSET MANAGEMENT (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the Asset Management in corporate approach | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO2 | Estimate the running cost and value for Asset Management | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO3 | Determine value using Asset Management Interpretation | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO4 | Illustrate Asset Management Decision making framework | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO5 | Explain the Capital Planning System | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| Course Code | 191AG6O02-WEATHER FORECAST IN AGRICULTURE (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the weather elements and their impact on crop production. | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - |
| CO2 | Identify the type of crop production risk and their management. | - | 1 | - | - | - | - | 1 | 1 | - | - | - | - | - | - |
| CO3 | Explain crop weather relationships and their responses. | - | 2 | - | 1 | 1 | - | 1 | - | - | - | - | - | - | - |
| CO4 | Classify the types of weather forecast and their characteristics. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO5 | Apply weather thumb rules and verification of weather forecast with real events. | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| Course Code | 191AG6O03-BIO-ENERGY SYSTEMS DESIGN AND APPLICATIONS (OPEN ELECTIVE- II) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the importance of Bioenergy. | 2 | - | - | - | - | 2 | 3 | - | - | - | - | - | - | - |
| CO2 | Compare and contrast Biomass and Agrochemical Conversion techniques. | 3 | 2 | - | 1 | - | 2 | - | - | - | - | - | - | - | - |
| CO3 | Categorize different ways of biomass production. | 2 | 1 | - | - | - | 2 | 3 | - | - | - | - | - | - | - |
| CO4 | Classify Gasification and Liquefaction. | 2 | 1 | - | - | - | 3 | 1 | - | - | - | - | - | - | - |
| CO5 | Analyze advanced Bio-diesel production from Oils and Seeds. | 2 | 1 | - | - | - | 3 | 1 | - | - | - | - | - | - | - |

| | CO Statements | | | | POs | | | | | | | | | | | | PSOs | |
|--------------|--|--|---|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191EC6L08-VLSI LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Contrast different levels of abstraction in HDL-Verilog. | | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | - | - | - | 2 | - |
| CO2 | Develop the Verilog code for digital logic circuits. | | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | - | - | - | 3 | - |
| CO3 | Analyze the cost parameters – area, delay and power dissipation of Digital Circuits on FPGA Hardware | | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | - | - | - | 3 | - |
| CO4 | Develop logic schematics as per the list of specifications from user. | | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | - | - | - | 3 | - |
| CO5 | Interpret the concepts of DRC, LVS and PEX in designing the ICs. | | 1 | 2 | - | - | 3 | - | - | - | - | 2 | - | - | - | - | 3 | - |
| Course Code | 191EC6L07-INTERNET OF THINGS LAB | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Choose the sensors and actuators for an IoT application. | | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | Select protocols for a specific IoT application. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | Utilize the cloud platform and APIs for IoT applications. | | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO4 | Experiment with embedded boards for creating IoT prototypes. | | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO5 | Design an IoT-based solution for a given problem. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| Course Code | 191HS6T07-EMPLOYABILITY SKILLS-IV | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Solve problems of seating arrangements ,syllogism | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO2 | Solve problems of Time and Work, Pipes and Cisterns, Time and Distance, Races and trains | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO3 | Solve Problems on Boats and Streams, Permutation and Combination, Probability and Data Interpretation | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| CO4 | Apply processes of Group discussion ,Phonetics, Leadership skills in real world | | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | 1 |
| CO5 | Apply principles of Group Dynamics, Interview Skills & Evaluation criteria in organizations | | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | 1 |
| Course Code | 191MC6A09-PROFESSIONAL ETHICS AND HUMAN VALUES | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Make use of values, morals and ethics in their day to day life. | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO2 | Identify what is right and wrong through moral ethics. | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO3 | Analyze experimental learning while developing the society with ethics. | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO4 | Apply ethical principles to resolve the problems that arise in work place. | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO5 | Apply adequate knowledge on global code of conduct. | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| VII Semester | | | | | | | | | | | | | | | | | | |
| Course Code | 191EC7T15-MICROWAVE AND OPTICAL COMMUNICATIONS | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Analyze the concepts of microwave systems and solve problems related to microwave transmission lines & waveguides. | | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | Explain the working of microwave tubes, components and measuring the devices for different applications. | | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191EE7O09-INDUSTRIAL ELECTRICAL SYSTEMS (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the electrical wiring systems for residential, commercial, and industrial consumers, representing the systems with standard symbols and drawings, SLD. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Illustrate the residential and commercial electrical systems. | 3 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | Design the residential and commercial lightning systems. | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain various components of industrial electrical systems. | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | Analyze and select the proper size of various electrical system components. | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191ME7O13-OPTIMIZATION TECHNIQUES (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Use advanced optimization techniques to solve real-life problems. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | Formulate and solve various practical optimization problems in manufacturing and service organizations | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | Use non-linear optimization techniques such as classical optimization methods, integer programming. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | Apply unconstrained optimization and constrained non-linear programming and dynamic programming | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | Use Advance techniques to formulate and solve the optimization problems. | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Course Code | 191ME7O14-ENERGY CONSERVATION (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the concepts of National Energy consumption, Energy Auditing, and its types | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Explain the improvement in efficiency of various electrical equipment's like capacitors and electric motors etc. | 1 | 2 | 1 | | - | - | - | - | - | - | - | - | - | - |
| CO3 | Explain the improvement in efficiency of various mechanical equipment like boilers, condensers, and steam lines etc. | 1 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | Explain the energy efficiency of components like pumps, blowers, fans, and various refrigeration equipment. | 1 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | Apply the concepts of energy economics like payback period, internal rate of returns life cycle costing etc. | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| Course Code | 191ME7O15-INTRODUCTION TO MATERIAL HANDLING SYSTEMS (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Demonstrate ability to complete successfully Forklift Certification to safely and operate effectively in the manufacturing environment. | 3 | - | - | - | - | - | - | - | - | - | 1 | - | - | - |

| | CO Statements | | | | POs | | | | | | | | | | | | PSOs | |
|-------------|--|---|---|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191CS7O11-MOBILE APPLICATION DEVELOPMENT (OPEN ELECTIVE- III) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Make use of Android Studio to develop Android application | 3 | - | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Develop user Interfaces using Android platform. | 2 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Make Use of state information across important operating system events | 2 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Apply Java programming concepts to Android application development | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Explain the concepts of GPS and mobile security | 2 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191CS7O12-DATA SCIENCE (OPEN ELECTIVE- III) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Describe Data Science and the skill sets needed to be a data scientist. | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Apply basic tools for visualizing Data& optimization. | 2 | 2 | - | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Describe the process of reading and exploring data. | 2 | 2 | - | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Implement various machine learning algorithms for analyzing various datasets. | 2 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Analyze datasets using clustering and recommender systems | 2 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191IT7O06-MACHINE LEARNING (OPEN ELECTIVE- III) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Identify machine learning techniques suitable for a given problem | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Evaluate the performance of an algorithm used in an ML model | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Apply probability approximations and frame ordered and unordered rules for given machine learning problem | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Design multilayer model using techniques like back propagation, quadratic programming solution. | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Design models using conditional probability, logistic regression, and distance-based techniques. | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191IT7O07-QUANTUM COMPUTING (OPEN ELECTIVE- III) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Illustrate fundamentals of quantum information processing | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Explain quantum basics and principles | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | Apply various quantum algorithms for solving problems | 1 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Apply simple quantum algorithms and information channels in the quantum circuit model | 1 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Demonstrate Performance, Security and Scalability of quantum computing | 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | Analyze various quantum computing models and approaches | 1 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191IT7O08-BLOCK CHAIN TECHNOLOGIES (OPEN ELECTIVE- III) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Demonstrate the foundation of the Blockchain technology and understand the processes in payment and funding. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | Identify the risks involved in building Blockchain applications. | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191AG7O04 - GREENHOUSE TECHNOLOGY (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Design small scale polyhouse for drying purpose. | 3 | 2 | 1 | - | - | - | - | - | - | - | 2 | - | - | - |
| CO2 | Classify greenhouses based on construction materials. | 3 | 2 | - | - | 1 | - | - | 1 | - | - | - | - | - | - |
| CO3 | Explain the scenario of protective cultivation around the globe and in India. | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | Make use of non-chemical and chemical pesticides and growth regulators effectively in an environmentally responsible way. | 1 | - | 1 | - | - | - | 2 | 3 | - | - | - | - | - | - |
| CO5 | Assess the basic production requirements and the knowledge of horticulture crop cultivation in greenhouse. | 3 | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| Course Code | 191AG7O05-FLOODS AND CONTROL MEASURES (OPEN ELECTIVE- III) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Determine the peak rate of flood by rational, empirical methods and flood frequency by log normal, Gumbel's extreme value and log-Pearson type-III distribution methods. | 2 | 2 | 1 | - | 3 | - | - | - | - | - | - | - | - | - |
| CO2 | Explain importance of various flood routing techniques and flood control measures. | 3 | 2 | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| CO3 | Design of flood control projects and their cost economics estimation. | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - |
| CO4 | Estimate seepage through earth embankments and understand causes of failures. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Design of earthen dam and its stability analysis by different methods | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - |
| Course Code | 191EC7L09-DIGITAL SIGNAL AND IMAGE PROCESSING LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Develop basic programs in MATLAB | 2 | - | - | - | 2 | - | - | - | 2 | 2 | - | - | 2 | - |
| CO2 | Compare the performance of various digital filters | 3 | - | - | - | 2 | - | - | - | 2 | 2 | - | - | 2 | - |
| CO3 | Apply image enhancement and restoration techniques for image processing applications | 3 | - | - | - | 2 | - | - | - | 2 | 2 | - | - | 2 | - |
| CO4 | Evaluate the image processing algorithms on a real time hardware | 2 | - | - | - | 3 | - | - | - | 2 | 2 | - | - | 2 | - |
| CO5 | Evaluate the video processing algorithms on a real time hardware | 2 | - | - | - | 3 | - | - | - | 2 | 2 | - | - | 1 | - |
| Course Code | MICROWAVE AND OPTICAL COMMUNICATIONS LAB | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Demonstrate Reflex klystron Characteristics. | 2 | 1 | - | 1 | - | - | - | - | 2 | - | - | - | 2 | - |
| CO2 | Interpret parameters of various waveguide components. | 2 | 1 | - | 1 | - | - | - | - | 2 | - | - | - | 2 | - |
| CO3 | Explain various characteristics of LEDs. | 2 | 1 | - | 1 | - | - | - | - | 2 | - | - | - | 2 | - |
| CO4 | Illustrate the impact of optical devices with and without channel losses. | 2 | 1 | - | 1 | - | - | - | - | 2 | - | - | - | 2 | - |
| CO5 | Demonstrate various waveguide parameters for a given Multiport network | 2 | 1 | - | 1 | - | - | - | - | 2 | - | - | - | 2 | - |
| Course Code | 191EC7P03-INTERNSHIP | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Conduct a technical survey to identify a real world engineering problem | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | 1 | - |

| | CO Statements | POs | | | | | | | | | | | | PSOs | | |
|--------------------|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|---|
| CO2 | Analyze the industrial plant layout using technical expertise | 2 | - | - | - | - | 1 | 1 | | - | - | - | - | 1 | 1 | - |
| CO3 | Compare theoretical and real work environments in technical perspective | 2 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 | - | - |
| CO4 | Identify the challenges in the execution of operations | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - |
| CO5 | Execute the operations and report the results of assigned tasks using modern tools adhering to professional ethics | - | - | - | - | 2 | - | - | 2 | 1 | 1 | - | - | 1 | 1 | - |
| Course Code | 191EC7P04-PROJECT PART 1 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | Conduct technical survey to identify a real industrial problem to solve as a project work | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | 1 | - | - |
| CO2 | Estimate the resources & constraints in the process of execution | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 | - |
| CO3 | Develop technical procedure or planning & scheduling to execute an identified project work in line with societal and environmental implications | - | 2 | - | - | - | 2 | 2 | - | - | - | - | 1 | 2 | - | - |
| CO4 | Estimate the costs of individual stages and overall cost of the project in light of optimum resources allocation | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | Estimate the optimum project duration using quantitative techniques | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |

VIII Semester

| | CO Statements | POs | | | | | | | | | | | | PSOs | |
|--------------------|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| CO2 | Explain the importance of three phase circuits with Star& Delta connected balanced and unbalanced loads. | 2 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO3 | Illustrate various electrical networks by using principles of network theorems | 2 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO4 | Obtain the various network parameters for the given two port networks | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | Analyse the transient behaviour of electrical networks for DC excitations | 2 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| Course Code | 191EE8O12-ELECTRICAL MACHINES (OPEN ELECTIVE- IV) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Evaluate the effects of armature reaction in dc machines | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Determine the torque production mechanism and control the speed of dc motors. | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | Determine the voltage regulation and efficiency of single-phase transformers. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | Explain the operation and performance of three phase induction motor. | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | Apply methods of starting and correction of power factor with synchronous motor | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191EE8O13-POWER ELECTRONICS (OPEN ELECTIVE- IV) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the different types of power semiconductor devices and their Characteristics. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | Distinguish between 1φ and 3φ phase-controlled converters. | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | Analyze the operation of AC voltage controllers and cycloconverters. | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO4 | Analyze the operation of different types of DC-DC converters. | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO5 | Illustrate the operation of Inverters and application of PWM techniques. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191EE8O14-NON CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE- IV) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the prospects of renewable energy and solar energy. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| CO2 | Apply the knowledge of solar principles for its applications. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| CO3 | Discuss the working principles of wind and Bio-mass energy resources. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| CO4 | Illustrate the techniques and conversion principles of Geothermal and tidal energy resources. | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| CO5 | Explain the concept of Direct energy conversion | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| Course Code | 191ME8O18-FABRICATION PROCESSES (OPEN ELECTIVE- IV) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain the fundamentals of Casting and Casting Processes. | - | 2 | - | 2 | - | 2 | - | - | - | - | - | 1 | - | - |
| CO2 | Explain the basics of Welding and types of Welding processes. | - | 2 | - | 2 | - | 2 | - | - | - | - | - | 1 | - | - |
| CO3 | Explain the various technological approaches applied to the different hot working and cold working operations. | 1 | - | - | 2 | 2 | - | - | - | - | - | - | 1 | - | - |

| | CO Statements | | | | POs | | | | | | | | | | PSOs | | | |
|--------------------|--|---|---|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| Course Code | | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO4 | Explain the concept of various Extrusion processes and forces in extrusion. | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| CO5 | Explain the concept of Forging processes, Forging defects and forces in forging operations. | 2 | - | 2 | - | 2 | - | - | - | - | - | - | - | - | 1 | - | - | |
| Course Code | 191ME8O19-SMART MATERIALS (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Describe and characterize mechanical behaviour of smart materials. | 2 | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | |
| CO2 | Select materials for sensor applications based on required properties. | 2 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - | |
| CO3 | Characterize interaction between smart materials and simple structures in actuation and sensing. | 2 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - | |
| CO4 | Describe and characterize novel functions of smart materials using structure-property relationships. | 1 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - | |
| CO5 | Demonstrate the functions of smart structures. | 1 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - | |
| Course Code | 191EC8O10-MICRO ELECTRO MECHANICAL SYSTEMS (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Summarize the operation of micro systems, and their applications | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO2 | Classify the materials for micro system applications | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO3 | Explain the state-of-the-art for lithography and packaging techniques | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO4 | Extend the knowledge of basic approaches for various sensors and actuators design | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO5 | Apply the experience on micro systems for interdisciplinary applications | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Course Code | 191EC8O11-BASIC ELECTRONIC CIRCUITS (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Explain Superposition theorem and Phasors. | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO2 | Interpret about BJT and BJT Amplifier. | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO3 | Develop Operations performed by OP-AMP circuits. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO4 | Develop Counters and Registers using Flip-flops. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | |
| CO5 | Contrast Analog-to-digital and Digital-to -analog conversions. | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | |
| Course Code | 191EC8O12-PRINCIPLES OF COMMUNICATIONS (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | Illustrate Analog communication systems using amplitude modulation and demodulation. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| CO2 | Demonstrate Analog communication systems using angle modulation and demodulation. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| CO3 | Analyze various pulse analog and pulse digital modulation techniques. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| CO4 | Explain the process of reproduction of baseband signal. | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |
| CO5 | Compare and contrast various Multiplexing techniques used in Communication systems. | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | |

| | CO Statements | | | | POs | | | | | | | | | | | | PSOs | |
|-------------|--|---|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | CO4 | CO5 | Course Code | 191IT8O11-CLOUD COMPUTING (OPEN ELECTIVE- IV) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | Make use of Game programming platforms, frame works and engines to develop a game. | Create interactive Games. | | | - | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - |
| | CO1 | Interpret the key dimensions of the challenge of Cloud Computing | | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | CO2 | Identify the economics, financial, and technological implications for selecting cloud computing for own organization | | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | CO3 | Demonstrate the basic concepts of virtualization and implementation levels of Virtualization | | 2 | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| | CO4 | Classify various storage systems and models in cloud computing environment. | | 2 | - | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO5 | Analyze the Cloud Security risks and Mechanisms. | | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| | CO6 | Utilize cloud environment platform and tools for actively initiating, installing, and developing cloud-based applications | | 2 | - | 1 | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| Course Code | 191CS8O16-AR/VR (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Explain VR, its environments and hardware technologies for 3D interfaces. | | 2 | 1 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| | CO2 | Summarize 3D user interface input hardware in VR environment. | | 2 | 1 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| | CO3 | Make use of software technologies to build VR applications. | | 3 | 2 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| | CO4 | Develop 3D user interfaces using 3D interaction techniques. | | 3 | 2 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| | CO5 | Describe the fundamental concepts of AR | | 2 | 1 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| Course Code | 191IT8O09-DEEP LEARNING (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Demonstrate the mathematical foundation of neural network | | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| | CO2 | Explain various machine learning algorithms and their importance for data analysis. | | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| | CO3 | Illustrate the challenges and optimization strategies of deep neural network. | | 2 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| | CO4 | Build a convolutional neural network using different activation functions. | | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| | CO5 | Build and train RNN and LSTMs using sequence modelling. | | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| Course Code | 191IT8O10-BLOCK CHAIN TECHNOLOGIES (OPEN ELECTIVE- IV) | | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| | CO1 | Demonstrate the foundation of the Blockchain technology and understand the processes in payment and funding. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO2 | Identify the risks involved in building Blockchain applications. | | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO3 | Review of legal implications using smart contracts. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO4 | Analyze the present landscape of Blockchain implementations to understand Cryptocurrency markets. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO5 | Examine how to profit from trading crypto currencies. | | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |

| | CO Statements | | POs | | | | | | | | | | | | PSOs | |
|-------------|---|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Course Code | 191EC8P05-PROJECT PART 2 | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO5 | Outline plastic usage due to hands on experience through visit to a greenhouse and farmer's field. | | 3 | 1 | - | 2 | - | 2 | - | - | - | - | - | - | - | - |
| CO1 | Demonstrate technical skills of data collection and data analysis adhering to professional ethics | | 1 | 1 | - | - | - | - | - | 2 | - | - | - | 1 | 1 | - |
| CO2 | Design the solutions for the critical problem areas marked in data analysis in the light of environmental and societal adherence | | - | - | 3 | 2 | - | 1 | 1 | - | - | - | - | - | 1 | - |
| CO3 | Build a team of people to work together and communicate well in the critical stages of project progress. | | - | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 | 1 | 1 |
| CO4 | Use modern tools to derive conclusions of the project work effectively | | - | - | - | - | 3 | - | - | - | - | 2 | 1 | 1 | 1 | - |
| CO5 | Demonstrate the results of the project work as a functional product prototype / application / analytical solution for a specified operation | | - | - | - | - | 1 | - | - | - | - | 1 | 1 | 1 | 2 | 1 |